THE OHIO JOURNAL OF SCIENCE

VOL. XLI NOVEMBER, 1941 No. 6

ANNUAL REPORT

OF THE

OHIO ACADEMY OF SCIENCE

1941

THE OHIO ACADEMY OF SCIENCE

Organized 1891 Incorporated 1892

Affiliated with the American Association for the Advancement of Science

OFFICERS AND COMMITTEES FOR 1941–1942

President

EUGENE VAN CLEEF

Vice-Presidents

A. *Zoology:* J. PAUL VISSCHER
B. *Botany:* CLARENCE E. TAFT
C. *Geology:* GEORGE B. BARBOUR
D. *Medical Sciences:* PAUL C. KITCHIN
E. *Psychology:* HAROLD EDGERTON
F. *Physics and Astronomy:* R. S. SHANKLAND
G. *Geography:* A. J. Wright
H. *Chemistry:* WILLIAM MANUEL
I. *Mathematics:* C. O. WILLIAMSON
J. *Junior Academy:* C. W. JARVIS

Secretary

ARTHUR W. LINDSEY

Treasurer

EDWARD S. THOMAS

Executive Committee

Ex-Officio: EUGENE VAN CLEEF, ARTHUR W. LINDSEY AND EDWARD S. THOMAS
Elective: WM. LLOYD EVANS, ROBT. M. GEIST

Trustees of Research Fund

CHARLES G. SHATZER, term expires.....1942
PAUL B. SEARS, term expires.....1943
HERBERT OSBORN, *Chairman*, term expires.....1944

Library Committee

MRS. ETHEL M. MILLER, *Chairman*,
Librarian in charge of Academy Exchanges and Publications
JAMES R. PATRICK, term expires.....1942
FRANCIS E. RAY, term expires.....1943

Committee on Conservation

A. E. WALLER, *Chairman*, term expires.....1942
EMERY R. HAYHURST, term expires.....1942
L. E. HICKS, term expires.....1942
DWIGHT M. DELONG, term expires.....1943
T. H. LANGLOIS, term expires.....1943
J. D. SAYRE, term expires.....1943
G. W. CONREY, term expires.....1944
PAUL B. SEARS, term expires.....1944
E. L. WICKLIFF, term expires.....1944

Committee on Nominations for 1942

THE VICE-PRESIDENTS OF 1940–1941

Membership Committee for 1942

A. *Zoology:* ROBERT M. GEIST
B. *Botany:* CONSTANTINE J. ALEXOPOULOS
C. *Geology:* PARIS B. STOCKDALE
D. *Medical Sciences:* FRANK E. HAMILTON
E. *Psychology:* L. D. HARTSON
F. *Physics and Astronomy:* R. L. EDWARDS
G. *Geography:* RODERICK PEATTIE
H. *Chemistry:* PAUL ROTHEMUND
I. *Mathematics:* O. L. DUSTHEIMER
J. *Junior Academy:* J. W. BRANSON

Academy Representatives

(1) On Joint Administrative Board, O. J. S.: JAMES R. PATRICK, term expires 1942, and FRANCIS E. RAY, term expires 1943.
(2) On Council of the A. A. A. S.: WILLIAM H. ALEXANDER.
(3) On Save Outdoor Ohio Council: ROSCOE W. FRANKS.

The Council for 1941–1942

ALEXANDER, WILLIAM H.
ALEXOPOULOS, CONSTANTINE J.
BARBOUR, GEORGE B.
BRANSON, J. W.
DUSTHEIMER, O. L.
EDGERTON, HAROLD
EDWARDS, R. L.
EVANS, WILLIAM LLOYD
GEIST, ROBERT M.
HAMILTON, FRANK
HARTSON, L. D.
JARVIS, C. W.
KITCHIN, PAUL C.
LINDSEY, A. W.
MANUEL, WILLIAM A.
OSBORN, HERBERT
PATRICK, JAMES R.
PEATTIE, RODERICK
RAY, FRANCIS E.
ROTHEMUND, PAUL
SHANKLAND, R. S.
STOCKDALE, PARIS B.
TAFT, CLARENCE E.
THOMAS, EDWARD S.
VAN CLEEF, EUGENE
VISSCHER, J. PAUL
WALLER, A. E.
WILLIAMS, STEPHEN R.
WILLIAMSON, C. O.
WRIGHT, A. J.

REPORT OF THE FIFTY-FIRST ANNUAL MEETING OF THE OHIO ACADEMY OF SCIENCE

The fifty-first meeting of the Academy was held in Cleveland on May 8, 9 and 10, 1941. The local committee, under the chairmanship of Dr. J. Paul Visscher, planned sectional meetings in the Wade Park Manor Hotel, as well as the meeting of the council and the general meeting and banquet. Although the space available for sectional meetings was hardly adequate, the convenience of meeting under one roof was noteworthy, since the weather proved to be cold and rainy. The innovation is to be recommended where adequate space can be secured.

The general scientific meeting on Thursday evening, May 8, was also offered by the committee as an innovation. Dr. George M. Curtis, speaking on *Jared Potter Kirtland, Pioneer Naturalist of the Western Reserve*, and Dr. M. L. Pool on *Artificial Radio Activity and Its Application to Industrial and Medical Research*, contributed a most interesting program.

The Academy owes the local committee its gratitude for the pleasant setting of the meeting and for the facilities provided, as well as for the resources of the city that were made available to us.

At the meeting following the annual banquet, Dr. J. Paul Visscher, acting as toastmaster, presented Dr. William E. Wickenden of Case School of Applied Science and Dr. Webster G. Simon of Western Reserve University who spoke briefly to the assembled members. President Stephen R. Williams then read his presidential address, *The Saga of Paddy's Run*, an unusual contribution to the annals of the Academy but an interesting one, nevertheless.

In the business meeting following the banquet, Dr. Grover presented changes in the constitution as passed by the Council. The most momentous change dealt with Article XI, Section e, to permit the reversal of Council action by a majority vote of the members voting instead of the three-fourths formerly required. Another change established standing committees on necrology and resolutions in place of the former temporary appointments. The last change provided four year terms for Academy representatives on the Administrative Board of the Ohio Journal of Science, one representative to be elected every two years. The Academy duly adopted these changes.

Membership in the Academy was increased by twenty-eight, and the following members were elected to fellowship:

JOHN WARREN ALDRICH.....Western Reserve University
CONSTANTINE JOHN ALEXOPOULOS.....Kent State University
BERTIL G. ANDERSON.....Western Reserve University
FRANKLIN JAMES BACON.....Western Reserve University
MARION WATERMAN BOESEL.....Miami University
BENJAMIN P. BOLE, JR.....Cleveland Museum of Natural History
ARTHUR M. BRANT.....Ohio State University
ROBIN CHARLES BURRELL.....Ohio State University
DAVID CULBERTSON CHANDLER.....Stone Laboratory of Ohio State University
NORMAN F. CHILDERS.....Ohio State University
HARLA RAY EGGLESTON.....Marietta College
GEORGE MARION EHLERS.....University of Michigan
MORGAN WILLIAM EVANS.....Ohio Agricultural Experiment Station
ROSCOE WHITLOCK FRANKS.....Ohio State Civil Service Commission
WILLIAM FRANKLIN HAHNERT.....Ohio Wesleyan University
AUGUSTUS A. HALL.....Ohio State University
FRANK ERRETT HAMILTON.....Ohio State University
ARTHUR ROLAND HARPER.....Department of Education of Ohio, Columbus
FRANK O. HAZARD.....Wilmington College
EDWIN E. HEIZER.....University of Wisconsin
FREEMAN SMITH HOWLETT.....Ohio State University
CHARLES W. JARVIS.....Ohio Wesleyan University
CLYDE HAROLD JONES.....Ohio State University
GEORGE TALLMON JONES.....Oberlin College
JAMES BRIDGES LACKEY.....U. S. Public Health Service, Cincinnati
MILAN A. LOGAN.....University of Cincinnati
WILLARD MACHLE.....Kettering Laboratory, U. of Cincinnati
FRANCIS JOHN MOLZ.....University of Dayton
GEORGE DAVID MORGAN.....Denison University
DAVID C. RIFE.....Ohio State University
LEE STUART ROACH..Ohio Division of Conservation of Natural Resources, Athens
ALBERT RAY SHADLE.....University of Buffalo
RALPH V. SINNETT.....Ohio Wesleyan University
ARCHIE NORMAN SOLBERG.....University of Toledo
WALDO EDWARD STEIDTMANN.....Bowling Green State University
THOMAS C. SURRARRER.....Baldwin-Wallace College
ARAVILLA MEEK TAYLOR.....Lake Erie College
WILBUR METELLUS TIDD.....Ohio State University
WALTER ANDREWS TUCKER.....Columbus Dispatch
CARL ERNEST VENARD.....Ohio State University
CHARLES FREDERIC WALKER.....Stone Laboratory of Ohio State University
JOHN WEST WELLS.....Ohio State University
ARTHUR BALDWIN WILLIAMS.....Cleveland Museum of Natural History
ALFRED J. WRIGHT.....Ohio State University

The list of officers preceding this report shows the results of the election excepting one item. In presenting the report of the nominating committee Dr. Price suggested the name of Mr. William H. Alexander as historical secretary. Since this office is new, amendment of the constitution is required to create it. At the suggestion of several speakers Mr. Alexander was asked to act as historian until appropriate action could be taken to create such an office.

At this point action was taken on the committee for the revision of the constitution. The Academy voted to continue the committee of the past year under the chairmanship of Dr. Grover.

Dr. John G. Albright presented the report of the committee on Necrology and Dr. Edward W. E. Schear that of the Committee on Resolutions.

The meeting adjourned after brief discussion of several items of business of a less formal nature.

In presenting this brief report the secretary wishes to explain the delay in its presentation. The officers of several sections were not reported in the spring. Repeated inquiry failed to secure some of the names and in other cases no election had been held. At last, with the generous aid of President Van Cleef, the list was completed after the middle of September. Other peculiarities of the report must be laid to the fact that a change in secretaries itself causes some confusion.

Respectfully submitted,

A. W. LINDSEY, *Secretary.*

Report of the Treasurer

COLUMBUS, OHIO, May 9, 1941.

To the Ohio Academy of Science:

I submit herewith a financial statement of the condition of the Ohio Academy of Science as of December 31, 1940. The books have been audited and the opinion of the auditor is herewith attached.

Respectfully submitted,

EDWARD S. THOMAS, *Treasurer.*

BALANCE SHEET AS AT DECEMBER 31, 1940

Assets

CURRENT EXPENSE FUND:		
Cash in Bank—Current		$ 222.25
Cash in Bank—Semi-Centennial Celebration		607.40
Total Cash—Current Expense Fund (Schedule 1)		$ 829.65
Dues Receivable:		
1938	$ 10.00	
1939	60.00	
1940	362.50	
Total Dues Receivable		432.50
Interest Receivable (Bond coupons not cashed in 1940)		39.00
Bonds—Consolidated Federal Farm Loan 3 per cent 1945–55		1,300.00
Total Assets—Current Expense Fund		$2,601.15

RESEARCH FUND:		
Cash in Bank	$ 87.16	
Banc-Ohio Securities Company Stock (cost)	437.50	
Bonds—Fort Hayes Hotel, Columbus, Ohio (cost)	1,300.00	
Total Assets—Research Fund		1,824.66
Total Assets		$4,425.81

Liabilities, Deferred Credits and Net Worth

LIABILITIES:		
Accounts Payable		$ 260.61
DEFERRED CREDITS TO INCOME:		
Reserve for Uncollected Dues 1938, 1939 and 1940	$ 432.50	
1941 Dues Collected in 1940	20.00	
Total Deferred Credits to Income		452.50
Total Liabilities and Deferred Credits to Income		$ 713.11
NET WORTH:		
Ohio Academy of Science:		
Current Expense Fund Surplus	$1,378.25	
Semi-Centennial Celebration Surplus	509.79	
Research Fund Surplus	1,824.66	
Total Net Worth (Schedule 2)		3,712.70
Total Liabilities, Deferred Credits and Net Worth		$4,425.81

STATEMENT OF CASH RECEIPTS AND DISBURSEMENTS FOR THE YEAR ENDING DECEMBER 31, 1940

CASH BALANCE—DECEMBER 31, 1939:		
Ohio Academy of Science—Current Fund		$ 27.37
Semi-Centennial Celebration		100.00
Total Cash Balance—December 31, 1939 (as per books)		$ 127.37
DEPOSITS FOR THE YEAR:		
Ohio Academy of Science Receipts:		
Cash Received in 1939, Deposited in 1940	$ 2.50	
Dues 1940	1,197.40	
Dues 1939	55.00	
Dues 1938	22.50	
Dues 1941	20.00	
Research Grants	150.00	
Federal Farm Loan Coupons	19.50	
Sale of Publications	3.00	
Miscellaneous Income	1.00	
Total Deposits—Ohio Academy of Science	$1,470.90	
Semi-Centennial Celebration:		
Cash Received in 1939 Deposited 1940	$150.00	
Receipts for 1940	796.80	
Total Deposits—Semi-Centennial Celebration	946.80	
Total Deposits for the Year		2,417.70
Total Balance and Receipts		$2,545.07

DISBURSEMENTS (Checks Written):		
Ohio Academy of Science:		
Clerical Assistance		$ 11.60
Postage and Telegraph		69.70
Office Supplies and Expense		15.45
Expenses of Officers to Meetings		72.17
Printing:		
Proceedings of Ohio Journal of Science	$ 65.00	
Other	35.67	
		100.67
Subscriptions to Ohio Journal of Science		675.00
Research Grants		150.00
Secretary's Honorarium		100.00
Safety Deposit Box		3.30
Bond for Treasurer		5.00
Auditing Expense		15.00
Bank Charges		5.13
Reported Proceedings Annual Meeting		27.00
Miscellaneous Expense		26.00
Total Disbursements—Ohio Academy of Science		$1,276.02
Semi-Centennial Celebration and Junior Academy:		
Stationery and Office Supplies	$ 25.35	
Postage	38.62	
Committee Expenses	147.78	
Printing	18.25	
Honorariums to Speakers	150.00	
Speakers' Traveling Expenses	46.90	
Publicity	12.50	
Total Disbursements—Semi-Centennial Celebration and Junior Academy		439.40
Total Disbursements		1,715.42
CASH BALANCE—December 31, 1940		$ 829.65
Distributed as follows:		
Ohio Academy of Science		$ 222.25
Semi-Centennial Celebration		607.40
Total		$ 829.65

NET CASH BALANCE AFTER CONSIDERING OBLIGATIONS AS AT DECEMBER 31, 1940

	Cash	*Accounts Payable*	*Net*
Ohio Academy of Science	$222.25	$163.00	$ 59.25
Semi-Centennial Celebration	607.40	97.61	509.79
Totals	$829.65	$260.61	$569.04

COLUMBUS, OHIO, July 8, 1941.

The Ohio Academy of Science, Columbus, Ohio.

GENTLEMEN:—In accordance with your instructions, I have audited the accounts and records of the Treasurer of the Ohio Academy of Science for the year ended December 31, 1940.

All cash receipts and disbursements of the current expense fund were checked in detail for the period under review.

Cash in the bank was verified by bank confirmation and reconcilement with the book balance.

Investment securities on hand December 31, 1940, in the current expense fund, were examined and found to be as stated in the accompanying balance sheet. Cash and investment securities of the research fund were not verified in the course of this examination.

Members' dues accounts were not verified by correspondence with the members.

I hereby certify that, in my opinion, the accompanying Balance Sheet as at December 31, 1940, and related statement of Income and Expense fairly present the financial condition of the Ohio Academy of Science and the results of operation for the year ended that date.

Respectfully yours,

DANIEL M. SHONTING,
Certified Public Accountant.

Report of Trustees of the Research Fund

The accounts of the Research Fund for the year 1940 and submitted for audit as of December 31, 1940, were as follows:

CREDITS

Balance January 1, 1940	$ 193.93
Deposits during 1940	74.00
Total Credits	$ 267.93

DEBITS

Paid on Grants for Research from Research Fund	$ 178.91
Service Charges at Bank	1.86
Total Debits	$ 180.77
Balance in checking account January 1, 1941	$ 87.16

The Invested Funds are the same as a year ago:

Bonds (at cost)	$1,300.00
Stocks Ohio National Bank (at cost)	437.50
Total	$1,737.50
Cash Balance in Checking Account	87.16
Total Assets	$1,824.66

The allotment from the A. A. A. S. for research projects for 1940, cleared through Treasurer's office, was assigned to Dr. Archie N. Solberg, Toledo Univ., $50.00, and Dr. J. W. Frink, Univ. of Cincinnati, $100.00, for projects approved by the Trustees and acceptable to the A. A. A. S.

Later additions and anticipated income for the current year will give us a free balance of over $150.00 and applications for grants during the current year will be welcomed.

The grant from the A. A. A. S. for research was increased to $175.00 for the present year and this will permit a larger allowance for research

projects in progress. Since the allowance from the A. A. A. S. is likely to continue it would seem that we may anticipate grants of at least $200.00 each year. It is expected that all of the allowance from the A. A. A. S. will be expended during each year.

Respectfully submitted,

HERBERT OSBORN, *Chairman*,
C. G. SHATZER,
PAUL B. SEARS.

Report of the Joint Administrative Board of the Ohio Journal of Science

COLUMBUS, OHIO, April 26, 1941.

To the Ohio Academy of Science:

The only meeting of the Joint Administrative Board of the *Ohio Journal of Science* since the last report was held at the Ohio State University, April 26, 1941. Present were Messrs. Patrick, Lindsey, Transeau, Blake, Snyder, Meyer, Blaydes, and Miller. The meeting was called to order about 12:30 P. M., Dr. Patrick acting as chairman. The minutes of the preceding meeting were read and approved.

Dr. L. H. Snyder was elected Editor, Dr. G. W. Blaydes, Associate Editor, and Dr. John A. Miller, Business Manager of the *Journal* for the coming year. Dr. Blaydes had been serving as Associate Editor since last November when he was elected to that position by a mail ballot of the Board. Dr. Snyder's resignation, effective at the end of the coming year, was accepted with regrets. Dr. Meyer had advised the Board at its last meeting that he would not accept re-election as Business Manager for another year.

The Business Manager presented his report for the fiscal year 1939, as follows:

RECEIPTS

Balance from 1939	$ 35.98
University Allowance	750.00
Ohio Academy of Science—pro rata of dues	821.00
Subscriptions	125.06
Author's payments for plates	114.17
Sale of back numbers	19.89
Cleveland Clinic—Publication costs	160.00
Total	$2,026.10

EXPENDITURES

Spahr & Glenn Printing Vol. 40	$1,593.80
Bucher Engraving Company	195.80
Postmaster	122.00
Envelopes and stationery	36.90
Clerical assistance	7.50
Subscription refund	1.67
Bank charges	1.07
Total	$1,958.74
Balance on hand March 13, 1941 (Huntington National Bank)	67.36
	$2,026.10

Upon motion the report was accepted and placed on file. An auditing committee consisting of Dr. Transeau and Dr. Blaydes, found the report to be correct.

The Business Manager advised the Board of his action in deferring the mailing of foreign exchanges during present war conditions.

There was some informal discussion regarding the problems involved in publishing the 50th Anniversary number of the *Journal* and regarding the organization of the Board, but no formal actions were taken.

The meeting adjourned at about 2:00 P. M.

Respectfully submitted,

B. S. MEYER, *Secretary of the Board.*

Report of the Library Committee

COLUMBUS, OHIO, May 9, 1941.

To the Council of the Ohio Academy of Science:

The library committee has had no conferences and no correspondence this year.

The sales of publications amounted to $10.05. This sum plus six cents sales tax has been given to the Treasurer. A few Annual Reports were sold and ten Special Papers, half of which were Dr. W. G. Stover's Agaricaceae of Ohio. An order for a dozen copies of this paper has been received this year from Ohio University. This will appear in next year's report and will likely lead the list again in number of copies sold.

Last summer the mailing room at the Ohio State University obtained a new addressograph machine and made entirely new sets of stencils for the thirty or forty thousand names in its files including the members of the Ohio Academy of Science. The type is much larger and more easily read than were the former addresses. The new set of Academy cards was checked with the old set and a number of errors were found and corrected.

Several new exchanges have been added to the list. We now have 110 in this country and 272 abroad. Some of the foreign exchanges have come regularly during the past year, others intermittently and of course some not at all. More have come in the last few weeks than for several months. The first number of a new geography periodical in Spain was received recently with a request for exchange. No issues of our own *Ohio Journal of Science* have been sent this year to any place outside the Western Hemisphere. In January the Business Manager sent postal cards to the exchanges stating that all issues would be held here until a later time unless the recipient wished them sent at his own risk. So far no replies have been received.

The memorial volume in honor of the fiftieth anniversary of the founding of the Academy was the most important undertaking of the past year. Some of the members thought that it would be very appropriate to publish the pictures of the men and women who organized it and the chairman of this committee was asked to get them. Securing these pictures was a large and interesting piece of work and the history of it constitutes a large part of this report. The size of the task can be

imagined when one considers that I had a list of fifty-nine names with their addresses of fifty years ago. I knew that six were still living and that several had relatives in Columbus. Dr. Herbert Osborn and Dr. William L. Evans were very helpful in giving suggestions about possible sources. However there were no clues whatever for twenty-four names.

The next question to be settled was how to get the pictures copied when they should come. I asked Dr. Raymond C. Osburn if the photographer in the Zoology Department of the Ohio State University might be permitted to do the work. He agreed readily, stating that he thought that his department could well make that contribution to the Ohio Academy of Science.

Having thus disposed of the preface I was ready for the first chapter in the story of the pictures. I started with the most probable ones. When asking for the loan of a picture I always stated that it would be copied by the photographer in our building and would be returned promptly. The response was most gratifying. Everyone seemed much pleased that the pictures were to be published, many expressed a desire for a copy of the volume, and some said that they wished to purchase one or more copies. When the pictures were returned to the owners a small print was always enclosed, which seemed to be appreciated by the recipient. Much credit is due to the photographer, Mr. Louis Waszy, for his prompt and efficient work in making the negatives and prints.

After writing for all the probable ones I started on those for which I had no clues and it was very interesting to see how clues were found in the most unexpected places. There is an interesting story connected with nearly every picture. I usually began with the public library of the town where the person had lived in 1890 or at a later date if I could learn such. And without exception the librarians were most accommodating and helpful. Many pictures could not have been secured if they had not given the assistance which they did, for they either obtained the actual pictures and sent them to me or else they furnished good clues as to where I might succeed in locating them. They are Miss Gertrude Robertson of the Cleveland Public Library, Mr. W. J. Hamilton, Dayton; Mrs. Viola C. Marlatt, Defiance; Miss Florence L. Irwin, Geneva; Miss Jennie A. Shuman, Kent; Mrs. Ruth H. Pierce, Painesville; Mrs. F. W. Moulton, Portsmouth; and Miss Mary McCann of the Sandusky Public Library; Miss Eleanor S. Wilby of the Historical and Philosophical Society of Ohio, and Mrs. Corinne M. Simons of the Lloyd Library, both at Cincinnati. Also the same assistance was given by college librarians, Mr. Deckard Ritter of Ohio Wesleyan; Mr. R. E. Stauffer of Mt. Union; and Miss Marguerite Mitchell of Wilmington; by Dr. Byron H. Nellans, Dean of the Eclectic Medical College at Cincinnati; by various professors at Akron, Heidelberg, Mt. Union, Miami, Oberlin, Ohio University, Ohio Wesleyan, and Ohio State; by Mr. James D. Hartshorne of the Cleveland *Plain Dealer;* by Mr. C. W. Parrott, Vice-President of The Lowe Brothers Paint Company at Dayton; and by the Good Samaritan Hospital at Zanesville. All of these deserve much credit for the interest they took and the efforts which they made.

As a last resort I took the Columbus telephone directory and phoned to the people with the same name, asking if they were by any chance related to the person in question. Two pictures were secured in this way.

The Secretary of the Academy had offered to write to the six living members: Mr. J. N. Bradford of Columbus, Dr. E. G. Conklin of Princeton, Dr. C. B. Morrey and Dr. George W. Twiss of Florida, Professor E. L. Moseley of Bowling Green, and Dr. A. L. Treadwell of Vassar College. During my search for pictures I learned of three more: L. M. Bloomfield, a former professor at Ohio State University, who lives near Lancaster; G. P. Grimsley, who recently retired from many years' service in the offices of the Baltimore and Ohio Railroad at Baltimore; and H. A. Surface, former State Zoologist of Pennsylvania, who lives or winters in Florida. (I have just learned during September that Mr. Lucius A. Hine is living in Highland Park, Illinois.) Thus ten of the fifty-nine original charter members are still living.

I succeeded in obtaining fifty-six of the fifty-nine pictures. One seems to be wholly non-existent, that of Mr. L. W. Gunckel of Dayton, and so far I have failed to get one of Mr. Frank J. Combs of Columbus, and of Professor Ellen E. Smith of Lake Erie College, Painesville, who was one of the two vice-presidents when the Academy was organized and who died a year or so later, in 1893 or 1894. Pictures came from twenty places in Ohio, as follows, twenty-one from Columbus, three each from Cincinnati and Cleveland, two from Delaware, and one each from Adams Mills, Akron, Alliance, Bowling Green, Chillicothe, Cuyahoga Falls, Dayton, Geneva, Granville, Lancaster, Oberlin, Oxford, Painesville, Sandusky, Tiffin, and Wilmington. Four came from Florida, from Ft. Myers, South Miami, Vero Beach, and Zephyrhills, and one each from Baltimore, Chevy Chase, Chicago, Minneapolis, Philadelphia, Poughkeepsie, and Washington, D. C. They were secured directly from the living members, and from the widows, sons, daughters, granddaughter, sisters, nieces, cousins, and brother-in-law of the other members, from college collections of pictures, and from books, for in a few cases no separate picture could be located.

From one to eleven letters were required for each picture. The eleven were in regard to Miss Jane F. Winn, a vice-president in 1895. Her case seemed almost hopeless but finally the picture came very unexpectedly from a friend of hers in Chicago, with an interesting sketch of her life. Quite a number of biographies were sent with the various pictures to be kept in the files of the Academy, if not published.

The results to date show that one hundred and forty-nine letters and twenty postal cards were written, numerous telephone calls were made, and sixteen trips were taken in Columbus to get and to return pictures. These figures do not include the number of letters which were written by the Secretary to the living members. The postage on the letters, cards, and parcels of pictures amounted to six dollars which was paid by the Ohio State University Library. Four of the pictures had to be purchased as they were available only at photographic studios. The prices were fifty cents, one dollar and two dollars each but as I was able to sell the last one for a dollar the total cost to the Academy for the four pictures was $4.50. So the actual cash outlay has been $10.50. In

addition the Zoology Department of the Ohio State University furnished all the material for the negatives and prints, as well as the time of its photographer.

The entire project has taken much work and time. From September 26, 1940, when the first letters were written until January 7, 1941, when the last borrowed pictures were returned, the search for them consumed practically my entire time. Nearly everything else was either laid aside or handed over to my assistant. However, everyone co-operated so well and seemed so pleased that the pictures were wanted and were to be published in permanent form that it really was a very interesting task. There was always great satisfaction when a picture was received.

And now comes the next chapter in the story of these pictures. After securing them on the basis that they were to be published, the statement was made to me that there were no funds with which to do it, that there would be no memorial volume but that only the invitational addresses would be published in the May issue of the *Ohio Journal of Science*. I was much dismayed for I feel that we are under a moral obligation to all these people who sent pictures so willingly and gladly on the basis of their publication. They would make not more than seven plates and the cost would be between six and eight dollars a plate on the basis of a thousand copies. They could very well accompany the address on the history of the Ohio Academy of Science which was given by Dr. J. P. Porter last year. It would seem that the fiftieth anniversary should not be passed without the recording of its history in printed form.

Thus the final chapter to the story of the pictures has not yet been written. What it will be depends upon the action of the Academy. If it can find it possible to supply the fifty or sixty dollars necessary to publish them our obligation to the owners of these pictures can be fulfilled and the Academy will have a permanent record of its fifty-year history and of the men and women who organized it. On the other hand if the Academy be unable to see its way to appropriating this sum I shall be obliged to write about fifty more letters, stating that I regret it exceedingly but that it has not been found possible to publish them. Shall the story of the pictures have this kind of an ending as its last chapter or can we keep the pledges made to the owners of the pictures and thus give a happy ending to the story? May the Council decide.

Respectfully submitted,

Ethel Melsheimer Miller, *Chairman.*

Editor's Note: The pictures of which Mrs. Miller speaks were published in the July, 1941 issue of the Ohio Journal of Science.

Report of Committee on Resolutions

Resolutions of this, the fifty-first meeting of the Ohio Academy of Science and fourth Cleveland meeting:

The Committee on Resolutions recommends that we express our appreciation for the very cordial reception we have received from our

distinguished hosts, Western Reserve University and the Case School of Applied Science.

The precision with which the plans were formulated and have been and are being carried through are distinctly noteworthy and the fine spirit of co-operation on the part of the Wade Park Manor and the Convention Bureau of the Cleveland Chamber of Commerce is deserving special recognition.

The cultural atmosphere, the cordial co-operation on the part of the museums, the work of the entertainment committee in providing for the excursions and other features have made this meeting one long to be remembered by both members and guests.

Respectfully submitted,

RALPH V. BANGHAM,
H. RAY EGGLESTON,
EDWARD W. E. SCHEAR, *Chairman.*

Report of the Committee on Necrology

CLEVELAND, OHIO, May 9, 1941.

To the Ohio Academy of Science:

Notice of the death of four members of the Academy has come to the attention of your committee. The names are those of Dr. Maynard M. Metcalf, Dr. B. C. Freeman, Dr. Dayton C. Miller, and Dr. Francis H. Herrick. A short account of the life and work of each man follows:

MAYNARD M. METCALF

Dr. Metcalf was the retired Research Professor of Zoology of the Johns Hopkins University. He was born in Elyria, Ohio, in 1868, the son of Elijah Wright Metcalf and Maria Ely Metcalf. He was educated at Oberlin College and Johns Hopkins University, receiving the Ph. D. degree from the latter institution in 1893. He was Chairman of the Biology Department of Goucher College until 1906, when he became head of the Zoology Department of Oberlin College. In 1914 Dr. Metcalf resigned from college work to devote his time to research in the field. He worked both in this country and abroad. In 1924 he was Chairman of the Division of Biology and Agriculture of the National Research Council.

Dr. Metcalf was a member of the Ohio Academy of Science, and was its President in 1919. He had been a Trustee from 1913 to 1917. His published works numbered more than 150, dealing mostly with evolution, sociology, economics and philosophy. He died in Winter Park, Florida, April 22, 1940.

BRUCE CLARK FREEMAN

Dr. Freeman was a member of the Geology Department at the Ohio State University. He died August 25, 1940, in his sleep, while on a geological field trip for the Quebec Bureau of Mines. He was about 40 years of age.

Dayton C. Miller

Dr. Dayton C. Miller, distinguished scientist and teacher, died at his home in Cleveland on February 22, 1941. He was born in Strongsville, Ohio, on March 13, 1866. He received the B. S. and M. S. degrees from Baldwin-Wallace College, and the Doctorate of Science from Princeton University (1890). His first position was as instructor of mathematics and physics at the Case School of Applied Science, and he remained on the faculty for fifty years, rising through the rank of assistant professor to the head professorship of physics. He retired from active duty in June, 1940. He was responsible for the plans and construction of the Rockefeller Laboratory of Physics at Case. His chief work was done in the field of acoustics. He invented the phonodeik, which made visible the complex wave-forms of sound waves, and amplified them several thousand times. His consultation was frequently asked in the improvement of the acoustical qualities of large auditoriums. Among his notable researches were those concerning the tone qualities of musical instruments. He was a lover of music, and composed about thirty pieces of music for the piano, the flute and other musical instruments. Among his works are eight published books.

He was a member of the National Academy of Sciences as well as many other scientific organizations. He received at various times five honorary doctor's degrees. He was an inspiring teacher and a most productive research worker.

Francis Hobart Herrick

Dr. Herrick was born in Woodstock, Vermont, on November 19, 1858. He died in Cleveland on September 11, 1940. He received his formal education at St. Paul's School, Concord, N. H., graduated from Dartmouth College in 1881, and received the Ph. D. degree from Johns Hopkins University in 1888. He was Professor of Biology at Western Reserve University from 1888 until he became Professor Emeritus in 1929. He was known throughout the world for his work on the embryology and life history of Crustacea, especially the lobster. Outstanding was his definitive biography of the famous naturalist John James Audubon. In later years he conducted his well-known ornithological studies on the American Eagle.

Respectfully submitted,

John G. Albright, *Chairman*.

AUTHORS' ABSTRACTS AND BRIEF ARTICLES

A. THE SECTION OF ZOOLOGY

Courses of the Bald Faced Hornet (Dolichovespula Maculata)—By KELLEY HALE, Wilmington, Ohio.

In July, 1940, Nathan Hale discovered a queen's nest in the early stage of construction attached to the underside of the terra cotta above the entrance to Hale Surgical Hospital.

Daily photographs with 35 mm. Kodachrome were made through a 135 mm. telephoto lens mounted on a miniature camera until activity of the colony ceased in November, 1940.

It was soon discovered that the workers were using similar courses, some being quite complex due to large trees and buildings. Fourteen courses had been established and maintained throughout the season.

I quote from a letter received from Dr. Carl D. Duncan of San Jose State College, author of a fine book on the Vespena:

"On various occasions I have noted that wasps follow fairly definite courses in leaving and returning to their nests. However I do not know of anyone who has carefully observed such behavior for any length of time and published the results of his observations. It may be therefore, that you have collected data that are worthy of publication."

Suggested plan for solution of course problem of bald faced hornet:

1. Note carefully the courses followed by the queen during construction of the queen's nest.

2. Observe if the subsequent courses of the workers coincide or not with those of the queen. I am anxious to hear from as many observers as possible on this particular point.

3. I am desirous to know if each worker follows a particular course or is shifted from one course to another. To solve this point we could do the following experiments:

(a) Mark all the workers on a particular course dusting or spraying to see if they change courses.

(b) Net all the workers of a certain course and keep them in captivity long enough to see if others take their place. When released they should be marked for identification.

(c) Kill all the workers of a course with mustard shot.

(d) Kidnap the workers of a particular course and at a distance turn them loose at different times and points of the compass (after marking) and see how many return and by which routes.

(e) See if a hornet can return to the nest from a nearby point in its course after painting its eyes with an opaque substance.

(f) Disorient the nest if attached to a twig that can be removed.

4. If the queen does not lay out the courses perhaps the first brood does; if so, how do the subsequent or future workers learn the course or courses so well?

Since no published observations have been made on identical courses of Bald Faced hornets so far as I can learn, I am offering this paper

hoping to stimulate further work and experiments on this most intriguing subject.

I learned that it is a common belief that hornet nests are used more than one season. With rare exceptions this is not true.

B. THE SECTION OF BOTANY

Are the Green Algae Ancestral to the Embryophyta:—By George T. Jones, Oberlin College, Oberlin, Ohio.

Three primary objections to the theory that land plants arose from the Chlorophyceae are presented: (1) the ecological objection that a small green thallus adjusted to aquatic life would not be likely to survive if stranded on an unshaded beach; (2) it is contrary to all other experience that a complete parasite, such as the Riccia sporophyte, should develop autonomy; and (3) the necessary assumption that Riccia is primitive is not justified by the evidence of sequence of forms within the class Hepaticae itself. An alternative theory is proposed that the Embryophyta is more closely related to the Phaeophyceae than to any other group of living algae. Similarity of general form, identical modes of increase in size, ability to withstand drying, the occurrence of sieve tubes in both, multilocular gametangia, alternation of unequal generations, and the possibility of migration to terrestrial habitats through brackish marshes are cited as arguments in favor of the latter theory. The Pteridophytes and Phaeophyceae would both arise from a common stock, having alternation of equal generations, the former becoming terrestrial and the latter remaining marine. The Bryophyta would diverge from the most primitive Pteridophytes through reductive adaptation to an understory habit.

Water-Loss in Relation to Leaf Structure in American Holly, Tobacco, and Coleus:—By C. A. Swanson, Ohio State University, Columbus, Ohio.

Simultaneous determinations of the rate of water-loss in potted plants of *Ilex opaca, Nicotiana sp.*, and *Coleus blumeii* were made under the same environmental conditions. Despite the very thick cuticle and other "xeromorphic" peculiarities of holly leaves, the rate of transpiration per sq. dm. of lower leaf surface in this species was generally higher than in the other two species.

Growth Habits of Reed Canary Grass:—By Morgan W. Evans and J. Elbert Ely (deceased), Ohio Agricultural Experiment Station, Wooster, Ohio.

The underground rooting stems or rhizomes of reed canary grass (*Phalaris arundinacea* L.) originate chiefly during May, June, July, and August. Above-ground shoots develop in largest numbers during fall and early spring. In the latitude of northern Ohio, culms, with their elongated internodes, begin to form about or soon after the middle

of April. The proportion of shoots producing inflorescences increases with improved cultural conditions. Shoots which begin their growth in the spring and summer are not winter hardy, and their life is limited to the same season. The life of a shoot which develops in the fall is limited to the growing season of the following year.

In the latitude of northern Ohio, inflorescences begin to develop from the growing points of the shoots about or very soon after the middle of April; flowering begins in early June; seeds mature in late June and early July. Flowering and maturing gradually progress from just below the tip of the inflorescence toward its base. The leaves of reed canary grass are destroyed by temperatures not low enough to destroy the leaves of timothy, redtop, or Kentucky bluegrass.

The American Species of Micrasterias:—By R. K. Salisbury, Greenhills, Cincinnati.

The author has found twenty-two species, thirteen varieties, two forms of Micrasterias in Florida. Krieger (1939) has listed fifty-six (56) species and one hundred thirty-six (136) varieties for the world, of which thirty-three (33) species and thirty-seven (37) varieties are given for the United States.

Forms of *M. radiata* not heretofore published and a new variety of *M. sol* were shown.

M. radiata is very variable and appears to show characteristics of other species with which it is found. The validity of certain varieties established on the basis of spines is questioned.

Morphological Variations of Rhizopus Suinus Niels. Under Various Physiological Conditions:—By C. J. Corum, Western Reserve University, Cleveland, Ohio.

Continued sub-culture of *Rhizopus suinus* for a period of thirty months upon a synthetic nutrient agar medium resulted in gradual diminution in ability of the organism to produce spores. Finally a stage was reached in which there was no sporulation whatever, the mycelial mat produced being a pure white color.

In the weakly-sporing cultures several types of abnormalities were observed, viz.: peculiar bulbous hyphal enlargements, highly branched sporangiophores, great variations in size of sporangia and spores, and incomplete cleavage in some sporangia—all indications of an abnormal condition of the cultures. Other abnormal growths found in the sterile cultures were an extensive irregular branching of the hyphae, and an abundant occurrence of chlamydospores from which short germ tubes were frequently seen to protrude.

Restoration of the spore-forming ability of the cultures could be accomplished by growing the fungus on potato dextrose agar or on a synthetic agar to which thiamin had been added. The cultures could be returned rather rapidly to the non-sporulating condition by growing the fungus on a synthetic medium, using as a carbon source dextrose that had been extracted with acetone, alcohol, and ether to remove the thiamin.

The Forest Situation in Ohio:—By OLIVER D. DILLER, Ohio Agricultural Experiment Station, Wooster, Ohio.

Ohio has two distinct forest problems. In the hilly, southeastern, one-third where the timber tracts are relatively large, there are vast areas of worn out land where fire, overcutting, and soil erosion have depleted the soil, and lowered the standard of living. The greatest rural relief load is here.

In the level two-thirds the woodlands are in small, scattered patches, which total three and a quarter million acres, give the highest quality timber, and in spite of neglect produce an annual income of about four million dollars, or slightly over one dollar an acre. This is only about one tenth of the income that could be obtained under proper handling.

The problems of re-establishing forest cover by forest planting, and of properly protecting and managing the existing woodlands to produce a sustained yield of the higher grade timbers were discussed and illustrated. The need of adequate appropriations from the state legislature for carrying out a long time forest program was emphasized.

C. THE SECTION OF GEOLOGY

The Fauna and Stratigraphic Relationships of the Prout Limestone and Plum Brook Shale of Northern Ohio:—By ERWIN C. STUMM, Department of Geology, Oberlin College, Oberlin, Ohio.

The Prout limestone with its predominant coral and brachiopod fauna is correlated with the Centerfield limestone of the New York Hamilton. The guide fossils of this horizon with special mention of the brachiopods *"Spirifer" venustus, Camarophoria kernahani, Eunella attenuata*, and *Pentagonia bicostata*, are discussed. The underlying Plum Brook shale is correlated with the Skaneateles. The fossils of both formations are illustrated on five plates.

*Pseudo-Algal Nodules in the Greenfield Dolomite (Silurian of Ohio).*By JOHN W. WELLS, Department of Geology, Ohio State University, Columbus, Ohio.

The nodules found in the Greenfield dolomite at its type locality near Greenfield, Ohio, show no trace of structures attributable either directly or indirectly to algae and they are thought to be the result of physico-chemical deposition.

Stylolites—Primary or Secondary?—By PARIS B. STOCKDALE, Department of Geology, Ohio State University, Columbus, Ohio.

After surviving nearly two decades of general acceptance by American geologists, the solution theory for the origin of stylolites is being further studied in light of the substitute "contraction-pressure" theory

recently proposed by B. M. Shaub. According to the new theory stylolites are a *primary* structure which originated while sediments were in the unconsolidated state from differential pressure and contraction which compelled "transfer of material by plastic flow." The solution theory holds that stylolites are a *secondary* phenomenon developed after consolidation and hardening of strata through rock removal by differential chemical solution. The preponderance of field evidence along many lines shows that stylolite-making has involved removal of rock material after lithification of the sediments. A recently discovered occurrence of large and well-defined stylolites in sharply laminated limestone gives no evidence of readjustment or reshaping of sediments through differential squeezing or flow. The stylolites are of secondary origin and give further support to the solution theory.

The Relation of Geology and Physiographic History to Floods in the Muskingum Valley:—By H. Andrew Ireland, Soil Conservation Service, New Philadelphia, Ohio.

The Muskingum valley has a complex physiographic history brought about by several cycles of preglacial erosion, Pleistocene erosion, and glaciation. Quantitative evidence is given to show that soils, outwash gravel, and the more gentle slopes of glaciated areas allow absorption of a large amount of precipitation and large ground water storage results. The ground water is fed into the streams maintaining a large flow even during dry seasons. The gravel fill in the entrenched valleys of the Deep Stage has much more storage space than similar valleys filled with slack-water silt. Depletion curves, run-off graphs, and measurement of ground water accretion to stream flow are used as evidence of differential absorption. Differences are explained on the basis of geologic and physiographic conditions. The effect of drainage patterns inherited from preglacial systems and drainage changes due to glaciation are interpreted in regard to their effect on floods.

Relation of Soil-Creep to Earthflow in Eastern Ohio:—By C. F. Stewart Sharpe and Earl F. Dosch, U. S. Soil Conservation Service, New Philadelphia, Ohio.

Recent studies of soil movements on agricultural lands in parts of the Appalachian Plateau underlain by Pennsylvanian and Permian rocks containing numerous coals, clays, and shales reveal that the widespread slow process of soil-creep prepares the way for the localized and much faster earthflow.

On a typical hill slope in this area only the most massive beds of rock are exposed; the position of the weaker beds is obscured by a mantle of soil and rock debris. Road cuts and deep auger borings show that horizontal beds of coal, clay, and shale, instead of outcropping, thin abruptly and bend down slope several feet below the surface and may be traced down the hillside in attenuated form for as much as 200 feet. A clay or shale layer thus drawn out parallel to the slope interferes with downward percolation of surface water and of ground water that has moved laterally outward above the undisturbed clay stratum.

During and following heavy precipitation the more or less impervious blanket of creeping clay locally brings about saturation of overlying material, and, on moderate or steep slopes with insufficient vegetal cover to retain the soil, an earthflow may result.

Down-stream Narrowing of the Valley Floors of Lower Cuyahoga and Rocky Rivers:—By Henry F. Donner, Western Reserve University, Cleveland, Ohio.

In the lower six or eight miles of their courses, Cuyahoga River has cut into unconsolidated, glacial material whereas Rocky River has cut almost entirely into bedrock. For the last two and one-half miles both rivers seem to be in an earlier stage of physiographic development than they are farther up-stream. Difference in material along the valley is a minor cause, except in Rocky River where the valley cuts across the filled-in, preglacial channel. Evidence indicates that Big Creek may have entered Cuyahoga River some two miles farther down stream at an earlier stage. Both streams widened their valleys along their parallel courses until the divide separating them was removed. This, in part, may explain the wide portion of Cuyahoga Valley extending from Big Creek to a point about two miles north.

A general cause, affecting both rivers, was the repeated changing of the lake level. At any particular lake stage the stream entering it developed a somewhat winding course. As the lake dropped to a new level the old, winding course persisted but the portion connecting the old shore line with the new took a more direct course. Lateral cutting was greater in the winding parts than in the straight ones; hence these upper valleys were widened more rapidly than the lower ones.

*An Unusual Landslide**:—By Robert H. Mitchell, Muskingum College, New Concord, Ohio.

An unusual type of mass-movement occurred in a road cut near Zanesville, Ohio. In this slide the movement was largely horizontal, producing a "pseudo-graben" at the head of the slip. This condition is of interest since only normal slipping occurred on the opposite side of the road-cut under apparently similar conditions. Since the factors which favor mass-movement were present on both sides of the road-cut the different effects noted on opposite sides of the road must be due to varying combinations of the governing factors.

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*This article will appear soon in the Journal of Geology.

A PRELIMINARY SURVEY OF MEXICAN PSYLLIDAE (HOMOPTERA)

JOHN S. CALDWELL,
Circleville, Ohio

The psyllid fauna of Mexico has scarcely been touched and doubtlessly extensive collecting will recover many species recorded from America North of Mexico and from countries farther south along with species new to science. The data to substantiate this statement is contained in the few papers concerning Mexican Psyllidae and the fact that floral type scarcely conforms to international boundaries. The probable occurrence of species new to Mexico makes a key to the present species valueless; however, it appears that the majority of likely genera are represented and a tentative key is presented. The following compilation is based on data published by D. L. Crawford, F. Laing, H. G. Ferris, and E. P. Van Duzee, and the collections of D. M. DeLong and the writer's.

TENTATIVE KEY TO GENERA

1. Frons visible as a distinct sclerite; head never deeply cleft in front; genae not produced into cones.....2.
   Frons usually covered by genae; or if visible, head is deeply cleft in front; genae usually produced into cones.....5.
2. Frons visible from below as an elongate sclerite; vertex more or less flattened.....3.
   Frons visible from front as a rounded sclerite bearing the anterior ocellus; vertex rounded more or less downward in front. 4.
3. Forewings hyaline, ovate, sometimes maculate; no pterostigma present. Proctiger of male with posterior lobes.....**Aphalara**
   Forewings opaque, thickened, rhombodial; pterostigma present. Proctiger of male without caudal lobes.....**Aphalarioda**
4. Vertex, frons, and genae continuing in a uniform surface; antennae not longer than length of head and thorax combined. **Paurocephala**
   Vertex, frons, and genae not a uniform surface, genae slightly swollen on either side of frons; antennae very long. .**Heteropsylla**
5. Head very deeply cleft in front with antennae arising at base on either side accentuating the bifed appearance; frons sometimes visible.....6.
   Head not deeply cleft in front; frons never visible.....9.

6. Forewings with cubital petiole ..... 7.
Forewings without cubital petiole ..... 8.

7. Forewings with pterostigma and pseudocrossveins connecting radius and medius ..... **Carsidara**
Forewings with pterostigma but no pseudocrossveins between radius and medius ..... **Freysuila**
Forewings with neither pterostigma nor crossveins ..... **Epiciasa**

8. Posterior tibiae with never more than four apical spines; medius of forewings two branched ..... **Rhinopsylla**
Posterior tibiae with at least five apical spines; medius of forewings appearing three branched ..... **Synoza**

9. Forewings without a definite cubital petiole (*Ceropsylla* has either a tendency toward a petiole or a very short indefinite petiole); basal tarsus of hind legs without two black claws .... 10.
Forewings with a very definite cubital petiole; two black spines present of basal tarsus of hind legs ..... 15.

10. Genae produced into cones ..... 11.
Genae not produced into cones ..... **Kuwayama**

11. Forewings with a very short cubital petiole or tendency toward such; radius usually darkened ..... **Ceropsylla**
Forewings with absolutely no cubital petiole ..... 12.

12. Pronotum long, flat; forewings long, slender; genal cones projecting rather forward ..... **Leuronota**
Pronotum short, descending; forewings various, usually broad; genal cones descending ..... 13.

13. Genal cones short; clypeus visible from front ..... **Paratrioza**
Genal cones longer; clypeus not visible from front ..... 14.

14. Metacoxae without anterior spurs ..... **Trioza**
Metacoxae with anterior spurs ..... **Phylloplecta**

15. Thorax strongly arched; forewings somewhat rhombodial; species mostly robust ..... 16.
Thorax not strongly arched; forewings ovaloid; species not especially robust ..... 17.

16. Head and thorax perpendicular, pubescent, forewings hyaline with costa pubescent ..... **Spanioneura**
Head and thorax not perpendicular, not pubescent; forewings usually subhyaline ..... **Euphalerus**

17. No line of demarkation between vertex and genal cones; epimeron and episternum of prothorax subequal in length. **Psyllopsis**
Genal cones and vertex not fused; epimeron shorter than episternum ..... 18.

18. Genal cones usually separated at bases; vertex with a whitish ridge along either side of median line ..... **Mitropsylla**
Genal cones contiguous at base; vertex without marked ridges along median line ..... **Psylla**

RECORD OF SPECIES

Genus **Aphalara** Forster

Aphalara nupera Van Duzee. Angeles Bay, 5–4–21, and Gongales Bay, 4–29–21, Lower California, (E. P. Van Duzee & J. C. Chamberlin). The elongate clypeus places this species in the *calthae* group.

Aphalara simila Caldwell. Mexico City-Toluca road km. 20, 11–24–38, (Caldwell). Tamazunchale, San Luis Potosi, 8–29–39, (D. M. & F. M. DeLong). Jiutepec, Morelos, 9–6–39, (DeLong & C. C. Plummer).

Aphalara veaziei metzaria Crawford. San Esteban Island, Lower California, 4–19–21, (Van Duzee & Chamberlin).

Aphalara numerica n. sp. Monterrey, Nuevo Leon, 11–1–38, (Caldwell).

Aphalara caudata Crawford. Mexico City, D. F., west 18 kms., 9–1–39, (DeLong & Plummer).

Aphalara punctellus Van Duzee. San Nicolas Bay, Lower California, 5–16–21, (Van Duzee & Chamberlin). The nine segmented antennae places this species in the subgenus *Anomocera.*

Genus **Aphalaroida** Crawford

Aphalaroida inermis Crawford. Santa Engracia, Tamaulipas, 11–8–38, (Caldwell).

Genus **Paurocephala** Crawford

Paurocephala magnifrons Crawford. Escuintla, Chiapas, 7–25–10, (Crawford).

Paurocephala (*Aphalara*) *mera* (Van Duzee). San Nicolas Bay, Lower California, 5–16–21, (Van Duzee & Chamberlin). This species was described as an *Aphalara* with a pterostigma. Its placement here is arbitrary as it is possible it may belong in *Metaphalara* Crawford* along with *M. ilicis* (Ashmead).

Genus **Heteropsylla** Crawford

Heteropsylla mexicana Crawford. Jalapa, Vera Cruz, 8–28–10, (Crawford). Tamazunchale, San Luis Potosi, 11–15–38, (Caldwell).

Heteropsylla forcipata Crawford. Oaxaca, Oaxaca, (A. Koebele), Tamazunchale, San Luis Potosi, 8–29–39, (DeLong). Jiutepec, Morelos, 9–6–39, (DeLong & Plummer).

Heteropsylla mimosae Crawford. Santa Engracia, Tamaulipas, 11–4–38 and 11–8–38, (Caldwell).

Heteropsylla hausachae n. sp. Santa Engracia, Tamaulipas, 11–4–38, 11–8–38, and 11–11–38; Acapulco, Guerrero, 11–22–38; Valles, San Luis Potosi, 12–1–38, (Caldwell).

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* D. L. Crawford: Broteria Serie Zoologica, vol. 22, fasc. 11, p. 60, 1925.

Genus **Carsidara** Walker

Carsidara gigantea Crawford. Mexico City, D. F., (H. H. Smith). Manazanillo, Colima; Petatlan, Guerrero; near mouth of Balasa River, Guerrero; Minatitlan, Vera Cruz, (G. F. Ferris). Iguala, Guerrero, 9–11–38, (DeLong).

Carsidara dugesii Loew. "Mexico," (A. Duges). Acapulco, Guerrero, (DeLong).

Carsidara mexicana Crawford. Acapulco, Guerrero, (C. F. Baker).

Genus **Freysuila** Aleman

Freysuila dugesii Aleman. Guanajuata, Guanajuata, (A. Duges).

Freysuila coahuayanae Ferris. Colima & Coahuayana, Colima, (Ferris).

Genus **Epicrasa** Crawford

Epicrasa corniculata Crawford. Petatlan, Guerrero, near mouth of Balsas River, Guerrero, (Ferris).

Genus **Rhinopsylla** Riley

Rhinopsylla jalapensis Crawford. Jalapa, Vera Cruz, 8–28–10, (Crawford).

Rhinopsylla nigra Laing. Orizaba, Vera Cruz, (F. D. Godman and H. H. Smith). Mexico City, D. F., west 18 Kms., 9–1–39, (DeLong).

Rhinopsylla elongagena n. sp. Mexico City-Toluca road km. 20, 11–24–38, (Caldwell).

Rhinopsylla rubrafacia n. sp. Cuernavaca, Morelos, 9–8–39, (DeLong & Plummer).

Genus **Synoza** Enderlein

Synoza pulchra Laing. Chilpancingo, Guerrero, (Smith). Colima, Colima, December, 1925, (Ferris).

Genus **Kuwayama** Crawford

Kuwayama medicaginis Crawford. Jalapa, Vera Cruz, (Crawford). Santa Engracia, Tamaulipas, 11–4–38, (Caldwell). Iguala, Guerrero, 9–11–39, (DeLong).

Kuwayama oaxacensis Crawford. Oaxaca, Oaxaca, (Crawford). Mexico City-Toluca road km. 20, 11–24–38, (Caldwell). Mexico City, D. F., 9–1–39, (DeLong).

Genus **Leuronata** Crawford

Leuronata mihoacana Ferris. Chinicuila, Michoacan, February, 1926, (Ferris).

Leuronata maculata (Crawford). Sihuatenejo, Guerrero, 2–19–26, (Ferris).

Genus **Paratrioza** Crawford

Paratrioza cockerelli Sulc. Santa Engracia, Tamaulipas, 11–5–38, (Caldwell). Mexico City, D. F., 9–13–39, (DeLong).

Genus **Ceropsylla** Crawford

Ceropsylla sideroxyli Riley. Zacutula, near mouth of Balasa River, Guerrero, (Ferris).

Ceropsylla johnsonii Crawford. Valles, San Luis Potosi, 12–1–38, (Caldwell).

Genus **Trioza** Forster

Trioza mexicana Crawford. Cuernavaca, Morelos, (Crawford).

Trioza mexicana minuta Crawford. Oaxaca, Oaxaca, (Crawford). Mexico City, D. F., 9–1–39 and 9–13–39, (DeLong & Plummer).

Trioza proximata Crawford. Oaxaca, Oaxaca, and Orizaba, Vera Cruz, August, 1910, (Crawford). Mexico City-Toluca road km. 20, 11–24–38, and Mexico City-Acapulco road km. 55, 11–23–38, (Caldwell). Mexico City, D. F., 9–1–39 and 9–13–39, (DeLong & Plummer).

Trioza longistylus Crawford. Mexico City, D. F., 9–13–39, (DeLong & Plummer).

Trioza arizonae Aulmann. Tamazunchale, San Luis Potosi, 8–29–39, (DeLong).

Trioza thoracia n. sp. Mexico City-Toluca road km. 20, 11–24–38, (Caldwell).

Trioza koebelei Kirkaldy. Cuernavaca Morelos, (A. L. Herrera). Santa Engracia, Tamaulipas, 11–4–38, (Caldwell).

Genus **Phylloplecta** Riley

Phylloplecta diospyri (Ashmead). La Providencia near Acapulco, Guerrero, (Ferris).

Genus **Spanioneura** Forster

Spanioneura arcuata (Crawford). Jalapa, Vera Cruz, 8–28–10, (Crawford). It may be of interest to note here that this species was taken on Bonefish Key, Florida, 2–22–40, (Caldwell)

Genus **Euphalerus** Schwarz

Euphalerus fasciatus Laing, Atoyac, Vera Cruz, (Smith).

Euphalerus gallicola Ferris. Near mouth of Balasa River, Guerrero, (Ferris).

Genus **Psyllopsis** Crawford

Psyllopsis mexicana Crawford. Acapulco, Guerrero, (Baker).

Genus **Mitrapsylla** Crawford

Mitrapsylla albalineata Crawford. Acapulco, Guerrero, (Baker). Oaxaca, Oaxaca, (Crawford).

Genus **Psylla** Geoffory

Psylla orizabensis Crawford. Orizaba, Vera Cruz, 8–28–10, (Crawford). Cuernavaca, Morelos, 9-8-39, (DeLong & Plummer).

Psylla nana Tuthill. Mexico City, D. F., west 18 kms., 9–1–39, (DeLong).

Aphalara numerica n. sp.

Length to tip of forewing, male 2.2 mm., female 2.5 mm.; forewing, male 1.6 mm., female 2 mm.

General color greenish yellow with small dark brown maculae on forewings. Scutum with the figure "1001" appearing in white with the ones short and broad, and the zeros not quite closed caudad.

Antennae slightly longer than width of head. Vertex deeply notched in front; foveae very deep; ocelli prominent. Cubital cell in forewings long, narrow; medial cell small.

Forceps of male short, clavate apically; inner apical tooth reaching to apex of forcep proper.

Female genitalia as long as rest of abdomen in dried specimens. Dorsum of dorsal valve gently sinuate.

Male holotype, female allotype, and paratypes from Monterrey, Nuevo Leon, 11–1–38, (Caldwell).

Heteropsylla huasachae n. sp.

Length to tip of forewing, male 2 mm., female 2.2 mm.; forewing, male 1.5 mm., female 1.7 mm.

General color yellow to yellow-orange; eyes and apex of antennae black; forewings sometimes milky.

Antennae about twice as long as width of head. Head as broad as thorax. Forewings subhyaline; pterostigma broad, short, almost touching the radial sector.

Proctiger of male suddenly narrowed in apical third. Forceps appearing hemipyriform with truncate apices in lateral aspect; in caudal view the inner lobes are visible and appear to be of same shape as outer lobes though slightly shorter.

Dorsal valve of female about one-half as long as rest of abdomen; dorsum sulcate. Ventral valve about one-half as long as dorsal.

Male holotype, female allotype, and paratypes from Santa Engracia, Tamaulipas, 11–4–38; paratypes from same locality on 11–8–38 and 11–11–38, also paratypes from Acapulco, Guerrero, 11–22–38, and Valles, San Luis Potosi, 12–1–38, (Caldwell).

Trioza thoracia n. sp.

Length to tip of forewing 3.2 mm., forewing 2.8 mm.

General color light brown with legs and venter lighter; three apical segments of antennae black.

Antennae one-fourth longer than width of head. Vertex twice as broad as long; lateral and basal margins raised; apical margin deeply notched. Genal cones short, appressed, almost at right angles to plane of vertex; apices sharp. Prothorax almost perpendicular. Forewings about two and a half times as long as broad; rather rounded apically. Metacoxae with posterior spurs; hind tibiae with apical spine ratio of 3–1.

Forceps of male extremely long, slender, slightly curved cephalad; apices with a single black tooth projecting inward.

Male holotype from Mexico City-Toluca road km. 20, 11–24–38, (Caldwell).

Rhinopsylla elongagena n. sp.

Length to tip of forewing 3 mm., forewing 2.6 mm.

General color grey-yellow; vertex with narrow median stripe, meso- and metathorax with three and five red stripes respectively.

Anterior ocellus barely visible from above. Sulcate impressions on vertex almost obsolete. Genae greatly swollen, resembling rather blunt cones, yet clypeus is visible from front. Veins of forewings golden, three marginal spots deep black.

Dorsal valve of female greatly lowered in caudal third to styliform slightly upturned apex. Ventral valve with short styliform apex.

Female holotype Mexico City-Toluca road km. 20, 11–24–38, (Caldwell).

Rhinopsylla rubrafacia n. sp.

Length to tip of forewing 4 mm., forewing 3 mm.

General color of head and thorax light brown, abdomen black; basal antennal segments bright red; a white waxy secretion down median of abdominal dorsum.

Foveae in vertex very deep. Anterior ocellus not visible from above. Thorax scarcely arched; legs rather short. Forewings about three times as long as broad; apices not acute; three marginal spots scarcely visible.

Female genital segment short; ventral valve scarcely longer than preceding segment; dorsal valve short, thick, arched.

Female holotype from Cuernavaca, Morelos, 9–8–39, (DeLong & Plummer).

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Van Duzee, E. P. 1923. Expedition of the California Academy of Sciences to the Gulf of California in 1921. (The Hemiptera) Proceedings of the California Academy of Sciences 12: 199–200.

Aquatic Animals Have Osmotic Troubles

This systematic survey of the osmotic adjustments made by aquatic animals and the mechanisms which aid in these adjustments is most thorough in every respect. The phyla of the animal kingdom are treated separately. The sixteenth chapter considers eggs and embryos. Notes on methods are included. The list of references extends to nearly 280 titles which brings the literature up to the date of publication.

For one who is dealing with aquatic forms this book is obviously indispensable.—*W. M. Barrows.*

Osmotic Regulation in Aquatic Animals, by August Krogh. ix+242 pp. 54 figures and tables. London, Cambridge at the University Press, 1939. $3.75.

STUDIES IN ANTIBIOSIS BETWEEN BACTERIA AND FUNGI.

II. Species of Actinomyces Inhibiting the Growth of Colletotrichum gloeosporioides Penz. in Culture

CONST. J. ALEXOPOULOS

Phytopathological Laboratories,
Institut de Chimie et d'Agriculture "Nicolaos Canellopoulos"
Piraeus, Greece

Department of Biology, Kent State University

In the first paper of this series[1] the writer and his associates reported that *Actinomyces albus* Krainsky was found to inhibit the growth of all ten of the species of fungi against which it was tested in culture. The inhibitory effects were shown to be due to some chemical substance toxic to the fungi which the inhibiting organism probably manufactured in the medium. It was stated there, that during the past two years the writer "has observed that the colonies of organisms belonging to this genus (Actinomyces), occurring as contaminations in Petri dishes in the routine laboratory work with fungi, frequently inhibited the growth of many fungi." These observations led to experiments with a large number of species of Actinomyces in order to determine how universally such toxic substances are produced by members of this genus.

The fungus employed in these experiments was a monoconidial isolation of *Colletotrichum gloeosporioides* Penz. isolated from diseased twigs of *Citrus sinensis* Osb. from Gargalianoi, Greece. This was grown together with 80 different Actinomycetes obtained from the Centraalbureau voor Schimmelcultures, Baarn, Holland, as follows:

A. albidoflavus (R. D.) Gasp.
A. albidus Duché.
A. alboflavus W. et C.
A. albosporeus Krainsky.
A. albus (R. D.) Gasp.
A. albus (R. D.) Gasp. var. *alpha* Cif.
A. albus (R. D.) Gasp. var. *cretaceous* (Krüger) Wr.
A. albus (R. D.) Gasp. var. *ochroleucus* (Neuk.) Wr.
A. almquisti Duché
A. annulatus Beij.
A. asteroides (Ep.) Gasp.
A. aureus W. et C.
A. baarnensis Duché.
A. bobili W. et C.
A. bovis Harz.

[1]Ohio Jr. Sci., 38: 221–235, 1938.

A. buccalis (Wins.) West.
A. cacaoi Waks.
A. californicus W. et C.
A. canis (R. D.) West.
A. caprae (Sil.) Lieske.
A. carnosus Mill. et Burr.
A. cellulosae Krainsky.
A. chromogenus Gasp.
A. citreus Gasp.
A. clavifer Mill. et Burr.
A. craterifer Mill et Burr.
A. dassonvillei (B. R.) West.
A. deri (R. D.) West.
A. diastaticus Krainsky.
A. epidermidis (Rosenb.) West.
A. farcinicus (De T. et Trev.) West.
A. fimicarius Duché.
A. flavogriseus Duché.
A. flavovirens Waks.
A. flavus Krainsky.
A. flavus Mill. et Burr.
A. fradii W. et C.
A. gougeroti Duché.
A. griseus Krainsky.
A. halstedii W. et C.
A. heimi Duché.
A. intermedius Wr.
A. keratolytica Act. et McG.
A. krainskii Duché.
A. langeroni Salvanet-Duval.
A. lipmanii W. et C.
A. luteus (Ch. et Ar.) West.
A. maculatus Mill. et Burr.
A. madurae (Vinc.) Lehm. et Neum.
A. microflavus Krainsky.
A. nigrificans (Krüger) Wr.
A. odorifer (Rull.) Lieske.
A. oligocarbophilus Beij.
A. olivaceus Waks.
A. orangicus (R. D.) West.
A. pelletieri (Lav.) West.
A. pheochromogenus Conn.
A. praecox Mill. et Burr.
A. purpeochromogenus W. et C.
A. reticuli W. et C.
A. roseodiastaticus Duché.
A. roseus Krainsky.
A. ruber Krainsky.
A. rutgersensis W. et C.
A. salmonicolor Mill. et Burr.
A. sampsonii Mill. et Burr.
A. sanfelicei (Red.) West.
A. sanninii (Cif.) West.
A. scabies (Thaxt.) Güssow.
A. setonii Mill. et Burr.
A. sulphureus Gasp.
A. tenuis A. Cast.
A. tumuli Mill. et Beeley.
A. tyrosinaticus Krainsky.
A. verne W. et C.
A. violaceus-caesari W. et C.
A. violaceus-ruber W. et C.
A. viridis Mill. et Burr.
A. viridochromogenus Krainsky.
A. xanthostroma Wr.

No attempt was made to verify the identity of the various species, the names used being those supplied with the cultures by the Centraalbureau voor Schimmelcultures. All specific names regardless of their derivation are spelled in lower case letters.

Each species of Actinomyces was grown together with *Colletotrichum gloeosporioides* in the same Petri dish. The fungous inoculum was placed in the center of the Petri dish while the Actinomyces was inoculated two centimeters away from the center on opposite sides. The fungus was inoculated five days after the Actinomyces so as to give the latter an opportunity to become well established. The fungus was inoculated by means of a small loopful of a water suspension of conidia. The Actinomyces was inoculated by using a small loopful of a heavy, water suspension of the organism and dividing it between the two points of inoculation in the same Petri dish.

The medium employed was prepared according to the following formula:

Maltose	30.00	gr.
$MgSO_4$	.50	gr.
K_2HPO_4	1.00	gr.
KCl	.50	gr.
$FeSO_4$	.016	gr.
$NaNO_3$	2.00	gr.
Agar	20.00	gr.
Water	1000.00	cc.

Sufficient N/1 NaOH was added to the medium so that after sterilization the pH was approximately 7.4 .15 cc. of agar were used to the Petri dish. All tests were carried out in triplicate. Ten Petri dishes inoculated with the fungus alone served as controls. Observations on growth were made at intervals of 24 hours, and the inhibitory distances[2] recorded as in previous experiments.

According to the results obtained in these experiments, the 80 forms of Actinomyces studied can be classified into three groups with reference to their effect upon the growth of *C. gloeosporioides* in culture, as follows:

1. *Strong inhibitors.* Forms which inhibited the growth of the fungus at an inhibitory distance of 10 or more millimeters.
2. *Weak inhibitors.* Forms which inhibited the growth of the fungus at an inhibitory distance of less than 10 mm.
3. *Non-inhibitors.* Forms which had no effect upon the growth of the fungus.

The Actinomycetes are classified accordingly in Table I. It will be seen from this table that 45 (56.25%) of the cultures of Actinomyces tested, inhibited the growth of *C. gloeosporioides* while 35 (43.75%) had no effect upon the growth of the fungus. Of the inhibiting organisms 14 (31%) were strong inhibitors while 31 (69%) were weak inhibitors.

It now seemed advisable to test the ability of filtrates from liquid cultures of a few species of Actinomyces belonging to each of the above three groups, to retard the growth of the fungus. Accordingly, a liquid medium of the following formula was prepared:

Glucose	30.0	gr.
Peptone	5.0	gr.
KH_2PO_4	1.0	gr.
Water	1000.0	cc.

Sufficient NaOH was added to impart a pH 7.4 to the sterilized medium. No effort was made, however, to regulate the pH very accurately because previous experiments had shown that even rather large variations in pH did not seem to have an effect on inhibitory phenomena. 20 cc. of the medium were used to each 200 cc. flask.

From each Actinomycete group, three species were selected for this experiment. From the strong inhibitors, *A. ruber*, *A. flavus* Kr. and

[2]Ibid, p. 223.

A. oligocarbophilus were used; from the weak inhibitors, *A. bobili*, *A. flavovirens*, and *A. chromogenus*, while from the non-inhibitors, *A. albosporeus*, *A. sulphureus*, and *A. canis* were selected.

Three flasks of medium were inoculated for each of the above species. Four flasks were also inoculated with *C. gloeosporioides*, and four others

TABLE I

ACTINOMYCES SPECIES CLASSIFIED ACCORDING TO THEIR ABILITY TO INHIBIT THE GROWTH OF *Colletotrichum gloeosporioides* IN CULTURE ON MALTOSE AGAR

Strong Inhibitors	Weak Inhibitors	Non-inhibitors
A. albidoflavus	*A. albidus*	*A. albosporeus*
A. alboflavus	*A. albus* var. *alpha*	*A. albus* (R. D.) Gasp.
A. annulatus	*A. albus* var. *cretaceous*	*A. almquisti*
A. clavifer	*A. albus* var. *ochroleucus*	*A. asteroides*
A. farcinicus	*A. aureus*	*A. baarnensis*
A. flavus Kr.	*A. bobili*	*A. canis*
A. flavus Mill. et Burr.	*A. buccalis*	*A. carnosus*
A. krainskii	*A. bovis*	*A. epidermidis*
A. madurae	*A. cacaoi*	*A. fimicarius*
A. microflavus	*A. californicus*	*A. fradii*
A. oligocarbophilus	*A. caprae*	*A. griseus*
A. ruber	*A. cellulosae*	*A. halstedii*
A. sanninii	*A. chromogenus*	*A. heimi*
A. scabies	*A. citreus*	*A. keratolytica*
	A. craterifer	*A. luteus*
	A. dassonvillei	*A. nigrificans*
	A. deri	*A. olivaceus*
	A. diastaticus	*A. orangicus*
	A. flavogriseus	*A. pelletieri*
	A. flavovirens	*A. phaeochromogenus*
	A. gougeroti	*A. roseodiastaticus*
	A. intermedius	*A. roseus*
	A. langeroni	*A. rutgersensis*
	A. lipmanii	*A. salmonicolor*
	A. maculatus	*A. sampsonii*
	A. odorifer	*A. sanfelicei*
	A. praecox	*A. setonii*
	A. purpeochromogenus	*A. sulphureus*
	A. reticuli	*A. tenuis*
	A. verne	*A. tumuli*
	A. xanthostroma	*A. tyrosinaticus*
		A. violaceus-caesari
		A. violaceus-ruber
		A. viridis
		A. viridochromogenus

were left uninoculated to serve as controls. Sixteen days after inoculation, the organisms were filtered off by means of filter paper and the filtrates were used in preparing nutrient agar which after sterilization at 15 lbs. pressure for 15 minutes, was poured into Petri dishes and inoculated with a loopful of a spore suspension of *C. gloeosporioides*. Measurements of the largest and smallest diameter of each colony were made and recorded for seven days. The results are summarized in

Table II. The figures given are the averages of six diameters, one large and one small for each of three colonies. The flasks inoculated with *A. sulphureus* became heavily contaminated with a species of Penicillium and no results were, therefore, obtained for this filtrate.

TABLE II

SEVEN DAYS GROWTH OF *Colletotrichum gloeosporioides* IN AGAR PREPARED FROM VARIOUS FILTRATES, EXPRESSED IN AVERAGE DIAMETERS IN MILLIMETERS, OF THREE CULTURES

Organism from which Filtrate was Prepared	Diameter in mm.
Strong Inhibitors:	
A. oligocarbophilus	18.0
A. flavus Kr	30.5
A. ruber	34.0
Weak Inhibitors:	
A. flavovirens	57.0
A. bobili	60.5
A. chromogenus	63.0
Non-inhibitors:	
A. canis	58.0
A. albosporeus	59.5
A. sulphureus	Contaminated
Controls:	
C. gloeosporioides	49.0
Uninoculated	62.5

The results of these experiments indicate that the growth of *Colletotrichum gloeosporioides* is greatly inhibited by the filtrates taken from strong inhibitors, but not at all by the filtrates from the week inhibitors or non-inhibitors.

If inhibition of fungous growth is due to a toxic substance manufactured in the medium by the Actinomycetes—and there is little question as to that—several theories can be proposed to explain the facts observed.

1. It may be reasonably assumed that the difference between inhibitors and non-inhibitors is the ability of some Actinomycetes to produce a substance toxic to the fungus and the inability of others to manufacture such a substance.

2. The difference between strong and weak inhibitors may be explained either on a quantitative or a qualitative basis or both. If the toxic substance produced by the inhibiting Actinomycetes is assumed to be identical or similar in all species, then the degree of inhibition caused by different species may be a measure of the amount of toxin formed in a given period of time, the strong inhibitors differing from the weak in the speed with which they manufacture the toxin.

If the inhibiting substance is different in each case, however, it may be that that produced by the strong inhibitors is thermostable while that produced by the weak inhibitors is thermolabile. This would explain why the filtrates from weak inhibitors produced no inhibitory effects on the growth of *C. gloeosporioides*.

Furthermore, it is possible that a combination of factors are responsible for the discrepancy shown in the behavior of the weak inhibitors directly through their colonies on agar and indirectly through their filtrates. If, for instance, we assume that these Actinomycetes manufacture a relatively small amount of toxin which is partially or totally thermolabile we would expect results similar to those obtained. The amount of toxin which emanated from the colonies growing on agar may have been sufficient to cause a small amount of inhibition on the neighboring fungous colony, but enough of the toxin may have been destroyed in the filtrates of the liquid cultures when these were subjected to autoclaving so that no inhibitory effects could be produced on the fungus growing on media prepared from such filtrates.

3. Growth of the fungus on its own filtrate agar was much slower as compared to that on the uninoculated controls, as well as that on the weak-inhibitor and non-inhibitor filtrate agars. This seeming autoinhibition may be explained partly on the basis of an accumulation of waste products of metabolism in the liquid culture, and partly on the basis of a partial food depletion of the medium. Previous experiments have shown that food depletion of the medium is not responsible for the inhibitory effects caused by *Actinomyces albus* Kr. and it is reasonable to suppose that this would hold true to a large extent for other Actinomycetes. *Colletotrichum gloeosporioides*, however, produces a much greater growth than any of the Actinomycetes tested and consequently probably uses much more food.

An autotoxic substance similar to the toxin produced by the Actinomycete inhibitors cannot be postulated for *C. gloeosporioides* since two colonies of the fungus growing in the same Petri dish do not inhibit each other, but merge.

In view of the results reported herein, it would be of interest to determine if the production of a fungus-inhibiting toxin by certain Actinomycetes is in any way indicative of the relationship of such species.

This work was carried on in 1939 while the writer, on leave of absence from Kent State University, Kent, Ohio, was associated with the Institut de Chimie et d'Agriculture "Nicolaos Canellopoulos" as plant pathologist, at Piraeus, Greece.

The writer is deeply grateful to Dr. K. Nevros, Director of the Institut for the excellent laboratory facilities placed at his disposal for this and other studies; to Miss Adamantia Kokole for her valuable assistance during the laboratory work; to the administrative authorities of Kent State University for extending to him a year's leave of absence for work in Greece, and to all others who in any way assisted him during the progress of this investigation.

THE PHYSIOLOGICAL ACTIVITY OF CERTAIN ALCOHOLS AND ETHERS TO GOLDFISH

By HARVEY C. BRILL
AND
ALEXANDER K. PRESNELL
Miami University, Oxford, Ohio

Many alcohols and ethers that were laboratory curiosities a decade or two ago are now produced in industrial quantities and much interest has developed among investigators and others as to their possible utilization. Further, a note by Reid Hunt on the toxicity of ethylene glycol[1] has led the authors to undertake a comparison of the physiological activities of various alcohols and ethers on goldfish. Since goldfish are convenient to handle, and are relatively prompt to respond to their environment, thus giving results that are reliable and comparable, they are frequently chosen as the agencies for such measurements.[2]

EXPERIMENTAL METHODS AND RESULTS

Since ordinary tap water is non-toxic to goldfish and none of the compounds in the series that were tested react with the dissolved salts, aerated tap water was used as the solvent in this study. Water distilled from tin vessels or stored in tin vessels has been found to be toxic to goldfish. In all experiments 250 cc. of solution per fish were used and unless otherwise stated three fish were simultaneously submerged for each test. Three fish were introduced simultaneously into 750 cc. of solution as consecutive introduction may lead to uncertain results. Apparently absorption of the solute takes place so that the concentration of the solution is lowered and longer time intervals would be necessary to produce anesthesia in those fish introduced later. Evidence of this effect is supported by the data in Table I. Small fish were selected for experiment since they respond more promptly than larger fish on account of the larger body area per unit weight, and unit body area is a factor in sensitivity to environment.

The fish were maintained in water at a temperature of 31° C. at all times—a convenient temperature to maintain for the summer season.

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[1]Hunt. Ind. Eng. Chem. 24, 361 (1932).

[2]Adams, Ridla, Burnett and Dreger. J. A. C. S. 48, 1758, (1926).
Leffler and Brill. J. A. C. S. 55, 365 (1933).
Drake and Busbey. J. A. C. S. 54, 2930 (1932).

TABLE I

EFFECT OF FISH ON SOLUTION CONCENTRATION (ISOPROPIL ALCOHOL)

Concentration M/L	Fish No.		Time for Anesthesia	Time Before Removal	Condition At and After Removal
		TRIAL I			
0.35	1	Alcohol Isopropyl	3 min. 15 sec.	15 min, 15 sec.	Recovered extremely slowly.
0.35	2	" "	3 " 35 "	18 "	" " "
0.35	3	" "	3 " 50 "	20 "	Dead when removed.
0.35	4	" "	4 "	17 "	Recovered rather slowly.
		TRIAL II (Solution from Trial I)			
0.35	1	Alcohol Isopropyl	3 min. 50 sec.	18 min.	Recovered slowly.
0.35	2	" "	4 " 10	19 "	" "
0.35	3	" "	4 " 30 "	20 "	" "
0.35	4	" "	4 " 35 "	21 "	Recovered extremely slowly.
		TRIAL III (Solution from Trial II)			
0.35	1	Alcohol Isopropyl	4 min. 30 sec.	22 min.	Recovered slowly.
0.35	2	" "	4 " 40 "	24 "	" "
0.35	3	" "	5 "	26 "	Recovered very slowly.
0.35	4	" "	5 " 05 "	28 "	Dead when removed.

NOTE—Eastman Kodak Chemicals were used in most of the experiments.

In the first trial the average length of time for anesthesia to appear was 3 min. 40 sec., and 20 min. for death to take place; in the second trail the corresponding times are 4 min. 15 sec. and no fish died at 21 min. exposure; in the third trial the average time for anesthesia to take place on the four fish was 4 min. 50 sec. and death did not ensue until 28 min. of exposure. Each trial required a longer time than the preceding—rather conclusive evidence of a loss in concentration due to absorption of the solute as care was taken not to dilute the solution when new fish were introduced.

In the experiments recorded in the tables that follow all solutions were discarded after four fish had been submerged in them and new solutions made when needed.

Thus they were never subjected to abrupt changes in temperature which would make results more uncertain.

To determine the anesthetic state, a thermometer (weight 38.5 gms.) was allowed to rest on the tail of the fish. When no movement of the fish resulted from this pressure, it was concluded that anesthesia had set in.

Proof that aerated doubly distilled water as the solvent has no advantage over aerated tap water in such tests as are described is presented in Table II.

TABLE II

Comparative Effects of Ethyl Alcohol in Aerated Doubly Distilled Water and Aerated Tap Water on Goldfish

Fish No.	Fish Size		Concentration of Sol.	Time for Anesthesia, min.	Time Before Removal, min.	Condition at and After Removal
	Length mm.	Weight gms.				
Doubly Distilled Water						
1	41	2.1	M/L 0.4	65	70	Recovered
2	40	1.9	.....	80	90	Recovered slowly
3	42	2.3	.....	140	165	Remained anesthetized. Died later
Tap Water						
1	42	2.3	0.4	57	65	Recovered slowly
2	39	1.8	.....	75	85	Recovered slowly
3	42	2.3	.....	100	175	Died later

The data in Table II do not indicate any determinable differences in doubly distilled and tap water as solvents for ethyl alcohol, and tap water has been used throughout the rest of the experiments.

Solutions were made up of such strengths that anesthesia took place in less than ten minutes. The length of time for death to result was also determined. These results are listed in Table III and those that follow.

TABLE III

EFFECTS OF MONOHYDROXY ALCOHOLS ON GOLDFISH

Alcohol	Concentration M/L	Fish No.	Fish Size		Time for Anesthesia	Time Before Removal	Condition At and After Removal
			Length mm.	Weight gms.			
Methyl	0.60	1	41	2.1	.....	120 min.	No effect.
"	2.00	1	40	1.9	4 min.	5 " 30 "	Recovered readily.
"	2.00	2	39	1.8	4 " 50 "	7 " 30 "	Died without recovery.
"	2.00	3	39	1.8	4 " 55 "	9 "	Dead when removed.
Ethyl	0.40	1	42	2.3	57 min.	65 min.	Recovered readily.
"	0.40	2	39	1.8	75 "	85 "	Recovered slowly.
"	0.40	3	42	2.3	150 "	175 "	Died without recovery.
"	1.00	1	40	1.9	3 " 10 sec.	4 " 30 sec.	Recovered slowly.
"	1.00	2	43	2.5	4 " 30 "	6 " 35 "	Died without recovery.
"	1.00	3	42	2.3	6 "	9 "	Died without recovery.
n-Propyl	0.30	1	39	1.8	40 sec.	5 min. 30 sec.	Recovered.
" "	0.30	2	38	1.6	45 "	7 "	Recovered slowly.
" "	0.30	3	39	1.8	50 "	8 "	Died when removed.
" "	0.15	1	39	1.8	4 min.	15 " 30 sec.	Recovered.
" "	0.15	2	39	1.8	4 " 10 sec.	18 " 30 "	Recovered very slowly.
" "	0.15	3	39	1.8	5 "	21 " 31 "	Dead when removed.
iso-Propyl	0.20	1	37	1.5	10 min. 30 sec.	45 min.	Recovered slowly.
" "	0.20	2	39	1.8	17 "	48 "	Died without recovery.
" "	0.20	3	37	1.5	18 "	52 "	Dead when removed.
" "	0.35	1	37	1.5	3 " 15 sec.	15 " 15 sec.	Recovered extremely slowly.
" "	0.35	2	39	1.8	3 " 35 "	18 "	Recovered extremely slowly.
" "	0.35	3	38	1.6	3 " 50 "	20 "	Dead when removed.
" "	0.35	4	38	1.6	4 "	14 "	Recovered rather slowly.

TABLE III—(Continued)

Alcohol	Concentration M/L	Fish No.	Fish Size		Time for Anesthesia	Time Before Removal	Condition At and After Removal
			Length mm.	Weight gms.			
n-Butyl	0.40	1	39	1.8	30 sec.	45 sec.	Died without recovery
" "	0.40	2	41	2.1	34 "	45 "	Died without recovery.
" "	0.40	3	41	2.1	40 "	45 "	Died without recovery.
" "	0.05	1	40	1.9	50 "	1 min. 15 "	Recovered slowly.
" "	0.05	2	40	1.9	1 min.	1 " 35 "	Recovered slowly.
" "	0.05	3	41	2.1	1 " 5 "	1 " 50 "	Died without recovery.
" "	0.040	1	38	1.6	1 min. 30 sec.	3 min. 30 sec.	Recovered.
" "	0.040	2	39	1.8	2 "	5 " 30 "	Recovered.
" "	0.040	3	40	1.9	2 " 10 sec.	7 " 30 "	Died without recovery. (Apparent anesthesia as gills stopped movement, but swimming movements continued.)
" "	0.035	1	38	1.6	9 " 35 "	15 "	Recovered.
" "	0.035	2	40	1.9	10 "	19 "	Recovered.
" "	0.035	3	41	2.1	11 "	22 "	Died without recovery.
iso-Butyl	0.01	1	38	1.6	.....	90 min.	No effect.
" "	0.08	1	42	2.3	2 min. 20 sec.	3 " 30 sec.	Recovered promptly.
" "	0.08	2	40	1.9	2 " 20 "	5 " 30 "	Recovered promptly.
" "	0.08	3	43	2.5	2 " 30 "	7 " 30 "	Recovered promptly.
" "	0.08	4	41	2.1	2 " 20 "	9 " 30 "	Recovered very slowly.
" "	0.08	5	42	2.3	2 " 30 "	11 " 30 "	Recovered very slowly.
" "	0.08	6	42	2.3	2 " 30 "	13 " 30 "	Recovered very slowly.
" "	0.08	7	43	2.5	2 " 25 "	15 " 30 "	Recovered very slowly.
" "	0.08	8	42	2.3	2 " 30 "	17 " 30 "	Died without recovery.

TABLE III—(Continued)

Alcohol	Concentration M/L	Fish No.	Fish Size		Time for Anesthesia	Time Before Removal	Condition At and After Removal
			Length mm.	Weight gms.			
sec-Butyl	0.05	1	45	2.7	16 min.	31 min.	Recovered promptly.
" "	0.05	2	37	1.5	18 " 30 sec.	38 "	Recovered slowly.
" "	0.05	3	44	2.6	19 "	45 "	Recovered slowly.
" "	0.10	1	38	1.6	2 " 35 "	6 " 30 sec.	Recovered promptly.
" "	0.10	2	37	1.6	2 " 35 "	7 " 30 "	Recovered promptly.
" "	0.10	3	38	1.6	2 " 45 "	8 " 30 "	Recovered very slowly.
" "	0.10	4	38	1.6	2 "	10 " 30 "	Recovered very slowly.
" "	0.10	5	39	1.8	2 " 50 "	18 "	Recovered very slowly.
" "	0.10	6	38	1.6	2 " 40 "	21 "	Dead when removed.
tert-Butyl	0.10	1	38	1.6	20 min.	40 min.	Recovered very slowly.
" "	0.10	2	38	1.6	23 "	50 "	Recovered very slowly.
" "	0.10	3	39	1.8	27 "	60 "	Dead when removed.
" "	0.20	1	39	1.8	4 "	11 "	Recovered slowly.
" "	0.20	2	38	1.6	4 " 15 sec.	16 "	Recovered slowly.
" "	0.20	3	40	1.9	5 " 15 "	21 "	Recovered very slowly.
" "	0.20	4	39	1.8	4 " 25 "	26 "	Dead when removed.
Benzyl	0.25	1	38	1.6	Less than 20 sec.	30 sec.	Dead when removed.
"	0.05	1	38	1.6	20 sec.	30 "	Recovered slowly.
"	0.005	1	40	1.9	7 min.	19 min.	Recovered promptly.
"	0.0075	1	40	1.9	2 " 10 sec.	10 "	Recovered promptly.
"	0.0075	2	39	1.8	2 " 15 "	20 "	Recovered promptly.
"	0.0075	3	40	1.9	2 " 30 "	45 "	Recovered less promptly.
"	0.0075	4	40	1.9	2 " 20 "	60	Recovered less promptly.
"	0.0075	5	40	1.9	2 " 25 "	75 "	Recovered less promptly.
"	0.0075	6	39	1.8	2 " 20 "	90 "	Recovered less promptly.
"	0.0075	7	39	1.8	2 " 30 "	105 "	Recovered slowly.
"	0.0075	8	39	1.8	2 " 20 "	120 "	Dead when removed.

Not much comment is needed on the results of the experiments that are recorded in Table III.

Picaud is reported by Frankel[3] as finding the following ratios of toxicities on dogs for the normal alcohols when ethyl alcohol is given a value of 1.

TABLE IV

Comparative Toxicities of Alcohols to Fish

Alcohols	Picaud	Our Results
Methyl	⅔	½
Ethyl	1	1
n-Propyl	2	3
n-Butyl	3	20
iso-Propyl	.....	1½
iso-Butyl	.....	5
sec-Butyl	.....	5
tert-Butyl	.....	5
Benzyl	.....	20

These results agree quite well except those for n-butyl alcohol.

TABLE V

Comparative Narcotic Effects of Alcohols

Alcohols	Schneegans and Mering on Dogs[4]	Our Results on Fish
Methyl	Indecisive	½ (?)
Ethyl	1	1
n-Propyl	1	6
iso-Propyl	6	4
n-Butyl	2	25
iso-Butyl	.....	12
sec-Butyl	3	10
tert-Butyl	3	5
Benzyl	.....	125

The narcotic effects for the butyl alcohols are contrary to the statement attributed to Mering by Frankel[5] who is reported as finding that primary alcohols are less active narcotics than secondary alcohols and these less active than tertiary alcohols.

These differences in results may possibly be due to a difference in methods of administration on the experimental animals used or to both.

[3]Frankel, Die Arzneimittel-Synthese, Fourth Ed. (1919). Julius Springer, Berlin p. 132.

[4]Loc. cit. p. 473.

TABLE VI

EFFECTS OF GLYCOLS AND GLYCEROL ON GOLDFISH

Compound	Concentration M/L	Fish No.	Fish Size		Time for Anesthesia	Time Before Removal, min.	Condition At and After Removal
			Lgth mm.	Wgt. gms.			
Ethylene glycol	4.0	1	37	1.5	10 min.	13 min.	Recovered slowly.
" "	4.0	2	38	1.6	11 "	15 "	Died without recovery.
" "	4.0	3	39	1.8	11 " 30 sec.	17 "	Dead when removed. (Anesthesia incomplete in all three cases.)
Propylene glycol	1.0	1	37	1.5	.....	60 min.	No effect in 60 minutes.
" "	3.0	1	38	1.6	12 "	27 "	Died 2 hours later.
" "	3.0	2	38	1.6	13 "	30 "	Died later.
" "	3.0	3	40	1.9	15 "	33 "	Died later.
" "	3.0	4	38	1.6	12 " 30 sec.	24 "	Recovered readily. (Anesthesia incomplete in all cases.)
Trimethylene glycol	1.0	1	38	1.6	6 min.	15 min.	Recovered very slowly.
"	1.0	2	39	1.8	6 "	19 "	Recovered very slowly.
"	1.0	3	38	1.6	6 " 30 sec.	23 "	Recovered very slowly.
"	1.0	4	38	1.6	6 " 40 "	27 "	Died later. (Anesthesia incomplete in all cases.)
Glycerol.....	2.0	1	40	1.9	16 min.	17 min.	Died later.
"	2.0	2	39	1.8	19 "	20 "	Recovered slowly.
"	2.0	3	40	1.9	17 "	18 "	Recovered slowly. (Anesthesia incomplete in all cases.)

A study of the data in Table VI leads to the conclusion that the glycols and glycerol are not anesthetic to goldfish and that glycol is the least toxic to goldfish of the group investigated. These effects are in accord with a statement in Fränkel. (3d) 3d) (Loc. cit. p. 452).

TABLE VII
EFFECTS OF SEVERAL ETHERS ON GOLDFISH

Compound	Concentration M/L	Fish No.	Fish Size		Time for Anesthesia	Time Before Removal	Condition At and After Removal
			Lgth mm.	Wgt. gms.			
Diethyl ether....	0.30	1	38	1.6	20 sec.	1 min.	Recovered promptly.
" "	0.30	2	41	2.1	30 "	1 " 30 sec.	Recovered promptly.
" "	0.30	3	43	2.5	30 "	2 "	Recovered slowly.
" "	0.15	1	37	1.5	40 "	1 " 20 sec.	Recovered promptly.
" "	0.15	2	41	2.1	47 "	1 " 40 "	Recovered promptly.
" "	0.15	3	41	2.1	58 "	2 "	Recovered slowly.
" "	0.05	1	38	1.6	5 "	11 " 30 sec.	Recovered promptly.
" "	0.05	2	42	2.3	5 "	16 "	Recovered promptly.
" "	0.05	3	42	2.8	6 " 15 sec.	36 "	Recovered slowly.
" "	0.05	4	42	2.3	6 " 20 "	105 "	Recovered slowly.
" "	0.05	5	41	2.1	6 " 30 "	120 "	Dead when removed.
B, B'-dihydroxy-diethyl ether	0.6	1	38	1.6	.....	25 min.	No effect.
" "	2.0	1	38	1.6	.....	25 "	No effect.
" "	3.0	1	39	1.8	8 min.	17 "	Recovered very slowly.
" "	3.0	2	41	2.1	8 "	19 "	Dead when removed.
" "	3.0	3	41	2.1	8 " 30 sec.	21 "	Dead when removed. (Anesthesia incomplete in all cases.)
Ethylene glycol monoethyl ether	0.6	1	37	1.5	1 min. 55 sec.	11 min. 30 sec.	Recovered very slowly.
" "	0.6	2	37	1.5	2 " 10 "	13 " 30 "	Dead when removed.
" "	0.6	3	37	1.5	2 " 15 "	15 " 30 "	Dead when removed. (Anesthesia complete.)
Diethyleneglycol monoethyl ether	1.0	1	38	1.6	2 min.	8 min.	Recovered slowly.
" "	1.0	2	39	1.8	2 "	9 "	Recovered slowly. (Decidedly groggy end 5½ hours.)
" "	1.0	3	40	1.9	2 " 30 sec.	10 "	Dead when removed.

The results with the ethers are readily predictable. The presence of free hydroxyl groups lowers the narcotic powers of the ethers.

Mering used dogs and employed hypodermic injection. Our results would be governed by the amount of topical absorption which is dependent on relative solubility of a particular alcohol in water and fish tissue and the activity of the alcohol after absorption. There may be a marked difference in the distribution coefficients of isomeric alcohols. This problem might warrant further study.

A similar statement is found in Percy May's "The Chemistry of Synthetic Drugs."[6]

Benzyl alcohol has an enhanced narcotic effect over ethyl alcohol in comparison with its increase of toxicity, the ratio for ethyl alcohol (narcotic effect/toxicity) being one while that for benzyl alcohol is five.

A comparative measurement of the toxicities and narcotic activities to goldfish of methyl, ethyl, propyl (iso- and normal), butyl (normal-, iso, secondary-, and tertiary-) and benzyl alcohols; of ethylene, propylene, and trimethylene glycols, and of glycerol; and of diethyl, $\beta\,\beta$-dihydroxydiethyl, ethyleneglycol-monoethyl, and diethyleneglycol-monoethyl ethers has been made. The results are not in all cases in agreement with the data recorded in the chemical literature.

CONCLUSIONS

1. The toxicity of normal-butyl alcohol has been found to be higher than that recorded in the literature. The comparative toxicities of the different butyl alcohols is in disagreement with those recorded in the literature. Likewise their narcotic activities are not in accord with the recorded activities. Introduction of hydroxyl groups lowers the narcotic activity and in some cases causes it entirely to disappear.

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[5]Loc. cit. p. 133.

[6]May, Percy and Dyson, G. M. The Chemistry of Synthetic Drugs, Fourth Ed. Rev. (1939). (Longman's Green and Company, London, pp. 23 and 56).

Man

Like many other British books appearing these days, this one is made up of a collected set of the author's essays garnered from those published over a period of years as isolated writings. Unlike some others, however, this volume has a certain continuity of thought and singleness of purpose. The author finds that the war, with its necessary social changes, has served to tie together the lines of thought developed throughout the several essays, and to point the way towards a socio-biological outlook for the recreation of civilization after the war. The essays run the gamut of evolution, eugenics, anatomy, physiology, ecology, psychology, the concept of race, and religion. Each is challenging in the way only a Huxley could challenge. Scientist and layman alike will be the better informed for having read the book.—*L, H. S.*

Man Stands Alone, by J. S. Huxley. x+297 pp. New York, Harper and Brothers, 1941. $2.75.

PARASITES FROM FISH OF BUCKEYE LAKE, OHIO

RALPH V. BANGHAM,
College of Wooster,
Wooster, Ohio

During the summer of 1930 a study was made of the parasitism of the fish of Buckeye Lake as a part of a survey conducted by the Ohio Division of Conservation.

Buckeye Lake is located in portions of Licking, Fairfield and Perry Counties. It is a long irregular body of water seven and one-half miles east to west, varying in width from one-fourth mile in the east to one and one-half mile in the widest portion of the west end. It covers an estimated area of 4,200 acres. The water-shed is a low table land three to five miles wide. Several small streams enter and the lake drains through a waste weir into the south fork of the Licking River. The lake was originally flooded and dikes maintained to supply water for a portion of the Ohio Canal system. There are many shallow areas filled with vegetation. The bottom is mainly composed of soft mud although in areas where dredging operations are conducted, sand and gravel is coming in.

There are several small islands, one of the largest being of a peculiar formation. It is an anchored, floating sphagnum peat bog of approximately forty acres. There are numerous small ponds on the southwest end of the island. One of these ponds was selected as a seining station. It contained young carp, three species of bullheads, and mud minnows. These fish were infected with larval *Spiroxys* sp.

There were thirty-nine additional seining stations where visits were made every two weeks and seine hauls taken with a fifty foot net where vegetation and bottom conditions would permit. In case the larger net could not be used, a fifteen foot seine was substituted. A fyke net was also set in different locations for ten day periods and lifted twice daily. Forty-eight hundred fish from this net were identified, measured, tagged and released. A few were retained for examination of their parasites. Certain fish not taken by other methods were secured in gill nets.

Fish were examined while the parasites were living, then parasites were preserved and later stained, mounted and iden-

tified. Five hundred and four fish belonging to thirty-eight species were examined. Of this number 334 or 66.2 per cent were parasitized. This is a somewhat higher degree of infection than that found by Bangham and Hunter (1939), for parasites of Lake Erie fish. There, 2156 fish belonging to 79 species yielded a 58.3 per cent infection with at least one parasitic species. There were fewer different species of parasites in Buckeye Lake fish but a heavier infection of parasitic protozoa, copepods and cysts of larval Acanthocephala was found. In 1938, the writer examined 1380 fish belonging to 45 species from southern Florida and found 88.2 per cent parasitized, (Bangham, in press). Here the increase in parasitism was chiefly due to large numbers of encysted trematode metacercariae and larval nematodes which have their adult stages in fish-eating birds. More different species of parasites were encountered in a study in 1939 of fish of Algonquin Park lakes. In this area, 560 fish belonging to 22 species were examined and 84.3 per cent were infected (Bangham, in press). In this region water birds also play an important part in the life cycles of many of the fish parasites.

At Buckeye Lake the gills of fish were frequently infested by parasitic copepods and less often by gill flukes. Channel catfish, small-mouth bass and large-mouth bass in several instances carried cysts of myxosporidian forms on their gill filaments. A sporozoan encysted in the body cavities of young gizzard shad was the only parasite found in this fish species. This form was found in ten of twelve young gizzard shad when examined in the fall. This form apparently caused the death of numerous young gizzard shad.

Trematodes were not as numerous as in the same species of fish from Lake Erie. There were but few encysted strigeids and the infections were usually light. Moderately heavy infestations of gill flukes belonging to the family Gyrodactylidae were found on the tallow-mouthed minnow, tadpole madtom, mud pickerel, small-mouth bass, large-mouth bass, green sunfish, bluegill, pumpkinseed, white crappie and white bass. Another group of gill trematodes was represented by a single specimen of *Octobothrium* sp. taken from the tallow-mouthed minnow. *Paramphistomum stunkardi* Holl was found in small numbers in individuals belonging to six species of Buckeye Lake fish. This trematode was described by Holl (1929) from the pumpkinseed and warmouth bass of North Carolina. It was reported by

Venard (1940) from ten species of fish. Buckeye Lake represents the most northern record reported in the distribution of this parasite.

Cestodes belonging to the family Caryophyllaeidae were fairly numerous in common suckers, hog suckers, carp and satin-finned minnows. Unfortunately most of the specimens were lost before they were stained and identified. The only record of the family Bothriocephilidae was a single specimen of *Bothriocephalus formosus* secured from a Johnny darter. This species was described by Mueller and Van Cleave (1932) from the trout perch of Oneida Lake. In 1934, Van Cleave and Mueller included the Johnny darter as another host of this cestode. Three species of adult cestodes belonging to the genus Proteocephalus were found, *P. pinguis* in the mud pickerel, *P. pearsei* in seven species and *P. ambloplitis* in a few small-mouth and large-mouth bass. Larval stages of this latter cestode were encysted in ten fish species but the infections were light.

The nematodes are represented by several species but always in small numbers. Acanthocephala were secured in greater abundance. Encysted *Leptorhynchoides thecatus* (Linton) were taken from 15 fish species while adults were secured from the intestinal tracts of 13. Larval *Neoechinorhynchus cylindratus* (Van Cleave) were encysted in the livers of blue gills and pumpkinseeds while adults of this acanthocephalan were carried by large-mouth and small-mouth bass and green sunfish.

In the list of fish hosts and their parasites which follow, the parasites are listed in order of abundance, the number in parenthesis following the species indicates the number of individuals carrying the designated parasite. The asterisk preceding the name of the parasite indicates an immature stage (usually an encysted form).

1. *Dorosoma cepedianum* (Le Sueur). Gizzard shad.
   (Examined, 17. Parasitized, 5.)
   Microsporidia (5).
2. *Carpiodes cyprinus cyprinus* (LeSueur). Carp sucker.
   (Examined, 3. Parasitized, 0.)
3. *Catostomus commersonnii commersonnii* (Lacépède). Common sucker.
   (Examined, 23. Parasitized, 19.)
   Glaridacris catostomi Cooper (15).
   Biacetabulum infrequens Hunter (5).
   Leptorhynchoides thecatus (Linton) (1).
   Ergasilus versicolor Wilson (1).

4. *Hypentelium nigricans* (LeSueur). Hog sucker.
   (Examined, 2. Parasitized, 1.)
   Caryophyllaeidae (1).
5. *Erimyzon sucetta kennerlii* (Girard). Chub sucker.
   (Examined, 9. Parasitized, 5.)
   Neoechinorhynchus crassus Van Cleave (5).
   Ergasilus versicolor Wilson (1).
   Ergasilus centrarchidarum Wright (1).
   Ergasilus caeruleus Wilson (1).
6. *Moxostoma erythrurum* (Rafinesque). Golden sucker.
   (Examined, 1. Parasitized, 0.)
7. *Cyprinus carpio* Linnaeus. Carp.
   (Examined, 17. Parasitized, 8.)
   Caryophyllaeidae (7).
   **Spiroxys* sp. (1).
8. *Semotilus atromaculatus atromaculatus* (Mitchill). Creek chub.
   (Examined, 4. Parasitized, 3.)
   **Neascus vancleavei* (3).
9. *Notemigonus crysoleucas auratus* Rafinesque.
   (Examined, 7. Parasitized, 0.)
10. *Notropis deliciosus stramineus* (Cope). Northern sand shiner.
    (Examined, 7. Parasitized, 2.)
    Caryophyllaeidae (1).
    Allocreadium lobatum Wallin (1).
11. *Notropis spilopterus* (Cope). Satin-finned shiner.
    (Examined, 17. Parasitized, 2.)
    **Proteocephalus* sp.
    **Neascus vancleavei* (Agersborg).
12. *Notropis cornutus chrysocephalus* (Rafinesque). Mississippi common shiner.
    (Examined, 1. Parasitized, 0.)
13. *Ericymba buccata* Cope. Silver-jawed minnow.
    (Examined, 5. Parasitized, 0.)
14. *Hyborhynchus notatus* (Rafinesque). Blunt-nosed minnow.
    (Examined, 19. Parasitized, 9.)
    **Neascus vancleavei* (Agersborg) (9).
15. *Campostoma anomalum anomalum* (Rafinesque). Ohio tallow-mouthed minnow.
    (Examined, 7. Parasitized, 5.)
    **Neascus vancleavei* (Agersborg) (3).
    Octobothrium sp. (2).
    Allocreadium lobatum Wallin (2).
    Gryodactylidae (1).
    **Aganomena* sp. (1).
16. *Ictolurus lacustris punctatus* (Rafinesque). Southern channel catfish.
    (Examined, 15. Parasitized, 15.)
    Ergasilus versicolor Wilson (13.)

Corallobothrium fimbriatum Essex (9).
Henneguya exilis Kudo (3).
Corallobothrium giganteum Essex (1).
**Proteocephalus ambloplitis* (Leidy) (1).
Leptorhynchoides thecatus (Linton) (1).
Achtheres micropteri Wright (1).

17. *Ameiurus melas melas* (Rafinesque). Black bullhead.
(Examined, 17. Parasitized, 14.)
**Proteocephalus ambloplitis* (Leidy) (7).
Corallobothrium fimbriatum Essex (5).
Ergasilus versicolor Wilson (5).
**Spiroxys* sp. (4).
**Leptorhynchoides thecatus* (Linton) (1).

18. *Ameiurus nebulosus nebulosus* (LeSueur). Brown bullhead.
(Examined, 14. Parasitized, 10.)
Ergasilus versicolor Wilson (7).
**Proteocephalus ambloplitis* (Leidy) (6).
Corallobothrium fimbriatum Essex (4).
Leptorhynchoides thecatus (Linton) (2).

19. *Ameiurus natalis natalis* (LeSueur). Yellow bullhead.
(Examined, 11. Parasitized, 11.)
Leptorhynchoides thecatus (Linton) (7).
**Spiroxys* sp. (6).
Ergasilus versicolor Wilson (5).
Alloglossidium geminus (Mueller) (3).
Corallobothrium fimbriatum Essex (2).
**Camallanus* sp. (2).
Phyllodistomum staffordi Pearse (2).
Paramphistomum stunkardi Holl (1).

20. *Schilbeodes gyrinus* (Mitchill). Tadpole madtom.
(Examined, 15. Parasitized, 13.)
**Leptorhynchoides thecatus* (Linton) (7).
Gyrodactylidae (6).
Corallobothrium fimbriatum Essex (5).
**Spiroxys* sp. (3).
Alloglossidium corti (Lamont) (2).
Ergasilus caeruleus Wilson (1).
**Proteocephalus ambloplitis* (Leidy) (1).

21. *Esox vermiculatus* LeSueur. Mud pickerel.
(Examined, 18. Parasitized, 13.)
Leptorhynchoides thecatus (Linton) (6).
**Leptorhynchoides thecatus* (Linton) (6).
Paramphistomum stunkardi Holl (4).
Proteocephalus pinguis La Rue (3).
Macroderoides flavus Van Cleave and Mueller (2).
Gyrodactylidae (1).
Microphallus ovatus Osborn (1).

22. *Umbra limi* (Kirtland). Western mud-minnow,
(Examined, 4. Parasitized, 4.)

**Spiroxys* sp. (4).
Hepaticola bakeri Mueller and Van Cleave (2).

23. *Fundulus notatus* (Rafinesque). Black-striped topminnow.
(Examined, 11. Parasitized, 5.)
**Leptorhynchoides thecatus* (Linton) (3).
**Agamomema* sp. (1).
**Proteocephalus* sp. (1).

24. *Labidesthes sicculus sicculus* (Cope). Northern brook silverside.
(Examined, 6. Parasitized, 0.)

25. *Perca flavescens* (Mitchill). Yellow perch.
(Examined, 17. Parasitized, 7.)
**Neascus ambloplitis* Hughes (5).
**Leptorhynchoides thecatus* (Linton) (3).
Proteocephalus pearsei La Rue (1).
**Neascus* sp. (1).
**Agamonema* sp. (1).

26. *Boleosoma nigrum nigrum* Rafinesque. Western Johnny darter.
(Examined, 8. Parasitized, 1).
Bothriocephalus formosus Van Cleave and Mueller (1).

27. *Percina caprodes caprodes* (Rafinesque). Ohio log perch.
(Examined, 12. Parasitized, 7.)
**Leptorhynchoides thecatus* (Linton) (5).
**Neascus* sp. (3).
Microsporidia (3).
**Camallamus* sp. (2).

28. *Poecilichthys caeruleus* (Storer). Rainbow darter.
(Examined, 3. Parasitized, 2.)
**Leptorhynchoides thecatus* (Linton) (2).

29. *Poecilichthys exilis* (Girard). Iowa darter.
(Examined, 12. Parasitized, 12.)
**Leptorhynchoides thecatus* (Linton) (12).

30. *Micropterus dolomieu dolomieu* (Lacépède). Small-mouth bass.
(Examined, 34. Parasitized, 29.)
**Proteocephalus ambloplitis* (Leidy) (15).
Ergasilus centrarchidarum Wright (13).
Leptorhynchoides thecatus (Linton) (10).
**Leptorhynchoides thecatus* (Linton) (7).
Neochinorhynchus cylindratus (Van Cleave) (4).
Myxosporidia (gill cysts) (4).
Ergasilus caeruleus Wilson (2).
Proteocephalus ambloplitis (Leidy) (2).
Proteocephalus pearsei LaRue (2).
Achtheres micropteri Wright (1).
**Camallanus* sp. (1).
**Agamomema* sp. (1).
Crepidostomum cornutum (Osborn) (1).
Paramphistonum stunkardi Holl (1).
**Neascus ambloplitis* Hughes (1).
Gyrodactylidae (1).

31. *Huro salmoides* (Lacépède). Large-mouth bass.
(Examined, 38. Parasitized, 38.)
Neoechinorhynchus cylindratus (Van Cleave) (18).
**Leptorhynchoides thecatus* (Linton) (18).
Ergasilus centrarchidarum Wright (15).
Myxosporidia (gill cysts) (14).
Leptorhynchoides thecatus (Linton) (12).
**Proteocephalus ambloplitis* (Leidy) (7).
Proteocephalus pearsei LaRue (4).
Gyrodactylidae (3).
**Neascus ambloplitis* Hughes (1).
Paramphistomum stunkardi Holl (1).
Ergasilus caeruleus Wilson (1).
Proteocephalus ambloplitis (Leidy) (1).

32. *Lepomis cyanellus* Rafinesque. Green sunfish.
(Examined, 15. Parasitized, 15.)
**Leptorhynchoides thecatus* (Linton) (15).
Paramphistomum stunkardi Holl (7).
Camallanus oxycephalus Word and Magath (3).
**Protecephalus ambloplitis* (Leidy) (2).
Gyrodactylidae (2).
Ergasilus caeruleus Wilson (2).
Leech (1).
Proteocephalus pearsei LaRue (1).
**Agamomema* sp. (1).
Anallocreadium sp. (1).
Glochidia (gill cysts) (1).

33. *Lepomas megalotis megalotis* (Rafinesque). Southern long-eared sunfish.
(Examined, 4. Parasitized, 4.)
**Leptorhynchoides thecatus* (Linton) (4).
Paramphistomum stunkardi Holl (3).
**Proteocephalus ambloplitis* (Leidy) (1).
Leptorhynchoides thecatus (Linton) (1).

34. *Lepomis gibbosus* (Linn.). Pumpkinseed.
(Examined, 20. Parasitized, 20.)
Ergasilus caeruleus Wilson (15).
**Leptorhynchoides thecatus* (Linton) (10).
**Neoechinorhynchus cylindratus* (Van Cleave) (5).
Leech (3).
Gyrodactylidae (3).
Anallocreadium sp. (1).
**Proteocephalus ambloplitis* Leidy (1).
Proteocephalus pearsei LaRue (1).
Myxosporidia (1).
Ergasilus centrarchidarum Wright (1).
Leptorhynchoides thecatus (Linton) (1).

35. *Lepomis macrochirus* Rafinesque. Bluegill.
(Examined, 39. Parasitized, 34.)
Ergasilus centrarchidarum Wright (20).

**Proteocephalus ambloplitis* (Leidy) (15).
**Leptorhynchoides thecatus* (Linton) (12).
Ergasilus caeruleus Wilson (9).
Camallanus oxycephalus Word and Magath (6).
Spinitectus carolini Holl (5).
**Neoechinorhynchus cylindratus* (Van Cleave) (5).
Leptorhynchoides thecatus (Linton) (3).
Gyrodactylidae (3).
Neascus vancleavei (Agersborg) (2).
**Agamomema* sp. (2).
Leech (2).

36. *Pomoxis annularis* Rafinesque. White crappie.
(Examined, 23. Parasitized, 7.)
Cryptogonimus chyli Osborn (4).
**Leptorhynchoides thecatus* (Linton) (2).
Ergasilus caeruleus Wilson (1).
Leech (1).
Gyrodactylidae (1).
**Proteocaphalus ambloplitis* (Leidy) (1).
Leptorhynchoides thecatus (Linton) (1).

37. *Pomoxis nigro-maculatus* (LeSueur). Black crappie.
(Examined, 2. Parasitized, 2.)
**Neascus vancleavei* (Agersborg) (2).
Cryptogonimus chyli Osborn (1).
Proteocephalus pearsei (1).

38. *Lepibema chrysops* (Rafinesque). White bass.
(Examined, 27. Parasitized, 12.)
Gyrodactylidae (4).
Proteocephalus pearsei LaRue (4).
Leptorhynchoides thecatus (Linton) (4).
Argulus stizostethii Kellicott (3).
Camallanus oxycephalus Ward and Magath (2).
**Corallobothrium* sp. (1).

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RELATION OF SAUGER CATCH TO TURBIDITY IN LAKE ERIE

KENNETH H. DOAN,
Franz Theodore Stone Laboratory,
The Ohio State University

Studies of meteorological and limnological conditions reveal that factors other than intensity of fishing may relate to the abundance of certain fishes in Lake Erie. Present investigations point to the importance of turbidity of water as a determinant of future availability of the sauger, *Stizostedion canadense* (Smith), to commercial operations in Ohio.

This research has been conducted at the Franz Theodore Stone Laboratory of The Ohio State University, under the direction of Dr. T. H. Langlois and members of the staff, and has received full help and co-operation from the Ohio Division of Conservation and Natural Resources. Monthly averages of the turbidity of Lake Erie, 3 miles off Cleveland, have been furnished through the kindness of Mr. Clyde Irwin, chemist at the Baldwin Filtration Plant in Cleveland.

The sauger constitutes about 7% of the total Ohio Commercial catch in Lake Erie. About 67% of these saugers are taken in trap nets, and 82% of the 1939 poundage was taken in the spring season in that portion of Ohio waters west of Fairport. These considerations have prompted inquiry into the relation between the sauger catch, the number of trap nets, and turbidity conditions in the spring.

At first, knowing that the greater part of the sauger catch was made with trap nets, the number of nets licensed and the total commercial poundage of saugers were compared from 1927 through 1939. (Table I). The correlation is quite insignificant. Also, variation in the sauger catch is greater than in the number of nets, indicating the possible influence of some factor other than intensity of fishing upon the abundance of fish.

April and May are the months in which saugers spawn and the fry hatch, in western Lake Erie. Supposing that there was a relation between the muddiness of the water and the success of spawning and survival of the young, evidence of this success should be apparent in the commercial catches after such time as the fish have attained the minimum legal length of 11 inches, which is when they are 3 years of age (2). In most seasons,

3-year-old fish are dominant in commercial catches. (Table II). Following such a course of reasoning, a statistically significant (1, 3, 4,) positive coefficient of correlation of 0.79 was found

TABLE I

THE SAUGER CATCH IS THE TOTAL COMMERCIAL POUNDAGE TAKEN IN THE OHIO WATERS OF LAKE ERIE. THE NUMBER OF NETS REPRESENTS THE SUM OF BOTH SPRING AND FALL TRAP NET LICENSES. TURBIDITIES ARE THE MEAN APRIL-MAY AVERAGES AT CLEVELAND. PRECIPITATION IS THE MEAN RAINFALL FOR APRIL-MAY AT TOLEDO, SANDUSKY AND CLEVELAND.

Year	Saugers, Lbs., Uncorrected for Number of Nets A	Saugers, Corrected, Lbs., 0000 Omitted B	Number of Nets C	Turbidity, p. p. m. D	Precipitation, Inches E
1927	1,144,197	124	6,939	22	5.7
1928	1,491,867	143	7,853	25	4.1
1929	1,528,887	156	7,356	44	9.9
1930	1,482,396	164	6,780	20	4.5
1931	1,726,528	181	7,166	9	5.4
1932	3,094,284	317	7,342	10	4.8
1933	2,124,111	218	7,333	23	7.1
1934	737,708	81	6,876	6	4.6
1935	1,479,410	147	7,543	(24) 6	4.2
1936	1,703,999	159	8,064	9	3.8
1937	1,172,194	102	8,648	18	6.9
1938	802,075	75	8,069	13	6.3
1939	1,661,269	160	7,793	.....	.....

Between D and A 3 yrs. later: $r = +0.79$ $z = 1.06$ $\sigma z = \pm 0.38$
$bAD = 49.8$ $aA = 732$

Between D and B 3 yrs. later (1927–'36) $r = +0.82$ $z = 1.15$ $\sigma z = \pm 0.38$

$rCA = -.002$ (Not signif.) rDE (1927–'38) $= +0.60$

TABLE II

NUMBERS AND AGES OF FISH IN SAMPLES OF OHIO COMMERCIAL SAUGERS, LAKE ERIE. MINIMUM LEGAL LENGTH, 11 INCHES.

Year	2 an	3 an	4 an	5 an
1937	0	12	10	0
1938	1	10	26	5
1939	0	140	82	2

between the mean April-May turbidities and Ohio sauger catches 3 years later, from 1927 to 1936. (Fig. 1). Correction of the catch figures, to allow for the various numbers of nets fished in different years, gives a correlation coefficient of +0.82, between

April-May turbidities and sauger catches 3 years later. These coefficients do not differ statistically.

There are various influences upon the turbidity of a lake. Nature of the shores, depth, the direction of the long axis of the lake in relation to the magnitude and direction of winds, and precipitation may all affect the turbidity of the water. Several rivers enter western Lake Erie along the south shore. These rivers flow through the rich soil of highly cultivated farmlands, and after every rain carry a heavy load of suspended matter into the lake. A statistically significant r of $+0.60$ was found between the mean April-May precipitation at Toledo, San-

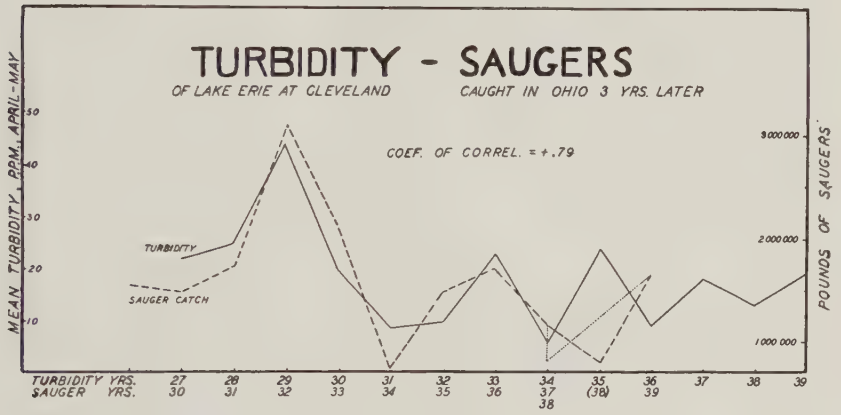
TURBIDITY - SAUGERS
OF LAKE ERIE AT CLEVELAND
CAUGHT IN OHIO 3 YRS. LATER
COEF. OF CORREL. = +.79
MEAN TURBIDITY, PPM, APRIL-MAY
POUNDS OF SAUGERS
TURBIDITY
SAUGER CATCH
TURBIDITY YRS. 27 28 29 30 31 32 33 34 35 36 37 38 39
SAUGER YRS. 30 31 32 33 34 35 36 37 38 (38) 39

FIG. 1 Graph illustrating the relationship between mean April-May turbidities of Lake Erie off Cleveland and the Ohio commercial catch of saugers three years later. The 1938 catch, as well as that of 1937, were largely of the same dominant year class of 1934 (see Table II), and both relate to the turbidity of 1934 as indicated by the dotted line.

dusky and Cleveland (5) and the mean April-May turbidity at Cleveland, from 1927 to 1938. Perhaps the precipitation did not affect the turbidity of the lake through turbid river inflow, as suggested, but that rainy weather was accompanied by high winds which stirred up the sediments in the shallower parts of the lake. In any event, by no matter how many degrees of relationship removed, a connection between precipitation and turbidity is apparent.

Three possible explanations to account for good sauger catches in Ohio 3 years after high spring turbidity may be suggested:

(1) The young saugers may, in clouded water, receive

protection from predators feeding chiefly by sight. A higher survival in turbid water would result.

(2) Limnological work at present being conducted by Dr. D. C. Chandler at the Stone Laboratory indicates that during periods of low light penetration, including high turbidity, microcrustacea are closer to the top than when the water is clear and more freely penetrable by light. Sauger fry feed near the surface when they are small, and so would have available a greater concentration of food under turbid conditions than when the water is clearer, with the plankton scattered down about 5 meters. Better feeding should promote a higher survival.

(3) Hatchery practice sometimes involves the use of powders, chalk or humus, to coat eggs which would otherwise adhere in clumps, the latter resulting in the smothering and death of the inner eggs. It may be that eggs freed by fish spawning in turbid waters rapidly gather a coating which makes them less able to adhere to one another. Eggs falling to the bottom singly might be expected to have a better chance of hatching than those in aggregations.

CONCLUSIONS

Of the factors, other than intensity of fishing, relating to the abundance of certain fishes in western Lake Erie, turbidity of the water is important. A highly significant degree of correlation ($r = +0.79$) has existed for the past 10 years between the mean April-May turbidities as measured at Cleveland and the total Ohio sauger catch 3 years later. There is considerable evidence that the lake turbidities during these months bear a significant relationship ($r = +0.60$) to the mean precipitation in the same months at several points along the southwestern shore of the lake. It is suggested that higher turbidities may act to prevent stickiness in sauger eggs, may give young fry protection from predators, and may facilitate the young saugers' feeding by concentrating plankton organisms near the surface.

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SUPPLEMENTARY NOTE ON THE EFFECT OF THE 1938 HURRICANE

MARY D. ROGICK,
College of New Rochelle,
New Rochelle, New York

The effect of the Sept. 21, 1938, New England hurricane on the ecology of the Fresh Water Pond at Woods Hole, Mass., with specific reference to the Bryozoa was briefly discussed in a previous paper (Rogick, 1940b). Collections had been made in the littoral zone of the specified pond before the hurricane (during the summer of 1938) when the pond water was fresh and the summer after the hurricane when the pond water was brackish. It is still brackish. The present supplementary note deals with the collection made in the same pond during the summer of 1940, more specifically with the collection made on August 1, 1940.

The writer is most deeply indebted to the Woods Hole Oceanographic Institute through whose courtesy and very kind co-operation an analysis of the pond water was obtained. The results of this analysis in parts per thousand were as follows: K—.04; Cl—1.96; Salinity—3.57. Roughly speaking this would be the equivalent of 1 part of harbor water (salt) to about 10 parts of pond water (fresh).

The pond bottom is sandy, with some rocks. As regards the present plant life of the pond no submerged pond weeds were observed. There were some diatoms, filamentous and other algae on the rocks. The top surface of many of the rocks was clean and free from growths of any kind. As regards the present fauna it was found to be not very abundant and not so very different from that of the preceding year. No sponges, coelenterates, platyhelminths, mollusks nor echinoderms were encountered. Among the protozoa were the following: *Euplotes*, *Cinetochilum*, *Zoothamnium*, *Coleps*, *Actinophrys sol*, *Amoeba proteus*, *Amoeba radiosa* and *Euglena viridis*. There were some small free-living nematodes, rotifers and gastrotrichs. There were also a few bloodworms and insect larvae, some in parchment cases, others in sandy cases, copepods, an amphipod *Gammarus fasciatus* and a barnacle *Balanus eburneus*. Of all the species present *Gammarus fasciatus* seemed the most abundant. In fact, it was far more common this year than last.

Most rocks fairly teemed with *Gammarus*. The barnacles were few in number and isolated. All those found were alive and quite large. To some of them were adhering a few algae-surrounded *Fredericella sultana* statoblasts. These statoblasts were split at least partially. A small wad of material or debris was between their valves as if an attempt to germinate had been made but had not advanced very far. At first thought one might suppose that these had been all that remained of *Fredericella* colonies which had settled and grown on the barnacles. However this would be an erroneous conclusion because of several factors. They could not have been formed on the

TABLE I

MEASUREMENTS OF 13 SESSILE STATOBLASTS OF *Plumatella* sp.

	Maximum in mm.	Average in mm.	Minimum in mm.
Total Length	0.57	0.524	0.48
Total width	.45	.403	.35
Capsule length*	.51	.452	.40
Capsule width*	.35	.325	.30
Vestigial float length	.06	.043	.02
Vestigial float width	.06	.047	.03
Cement ring diameter	.04	.025	.01

* The capsule measurements are inclusive of the cement ring.

barnacles by living colonies because they occurred in singles, without any definite adherence or deposition pattern, and because they were surrounded and fairly well encased in a thin covering of algal material and some debris. It is quite possible that these statoblasts were formed in 1938, in time washed against the barnacles and were finally attached to them. We must assume that these statoblasts were formed in 1938 (before the hurricane) when living *Fredericella* colonies were very abundant because in 1939 and 1940 no living colonies of fresh-water Bryozoa could be found in the pond, only dead colonies.

The fresh-water forms of 1938 had been replaced by the brackish water form *Membranipora lacroixii* in the 1939 collection (i. e., after the hurricane) while in the 1940 collection neither type was found in the living state. It was a little difficult to understand why *M. lacroixii* was not present in this year's collection but perhaps it may have been due to the low

salinity of the pond or to lack of food. Not even dead colonies of *Fredericella*, *Plumatella* nor *Membranipora* were encountered in the 1940 collection. Only sessile or fixed statoblasts of the fresh-water forms (*Fredericella* and *Plumatella*) could be found and these were all dead—remains of the 1938 crop. Most were empty-looking and a number had never germinated. Insect larvae had appropriated some of the statoblast valves for their cases, particularly for those cases which were made up largely of sand grains.

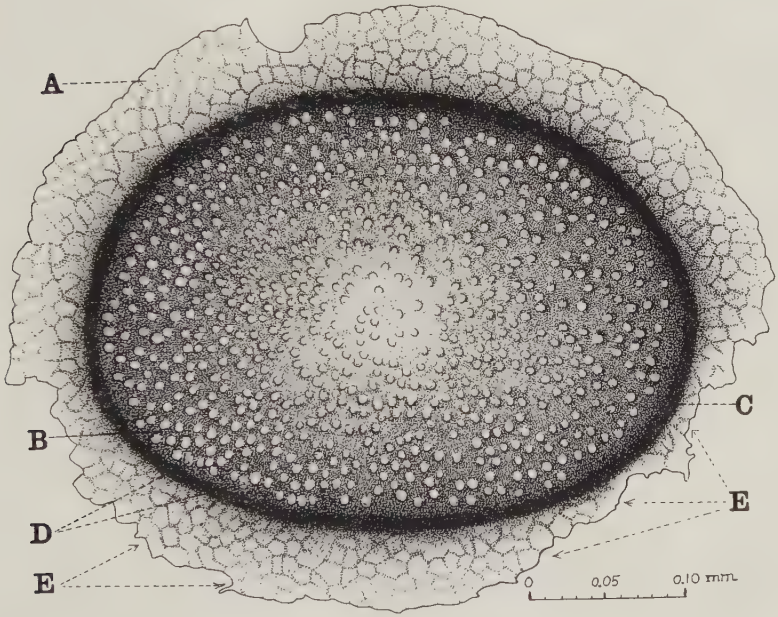

FIG. 1. A view of the upper unattached valve of a sessile *Plumatella* sp. statoblast. This specimen was collected in the Fresh Water Pond at Woods Hole, Mass., on Aug. 1, 1940. It is a very worn specimen as can be judged from the ragged appearance of the vestigial annulus or float or chitinous lamella as it is sometimes known. The annulus slants up a little from the edge of the capsule. Drawn with the aid of a camera lucida, a 5X ocular and a 45X objective. Key to the labels: *A*—vestigial annulus; *B*—capsule; *C*—cement ring; *D*—mammillations; *E*—damaged or worn area.

No free statoblasts of *Plumatella* sp. were found and that was to be expected because they rise to the surface when released, hence are more apt to be lost or missed in collecting. Moreover, they are very tiny, smaller than the sessile statoblasts. A number of sessile *Plumatella* sp. statoblasts were found. Many of these were very worn but still adhering to

the rocks, frequently in rows as they were when the colonies were alive in 1938. However, the zooecial tubes had all been worn away and lighter streaks and traceries remained on the rocks where the zooecial tubes had been in previous years. The zooecial tube ectocyst is not so resistant to disintegration as are the heavily chitinized statoblasts which may remain in water for several years without their valves disintegrating.

The identification of these *Plumatella* statoblasts further than the genus from sessile statoblasts alone is extremely difficult in the present case for several reasons: 1, the present lack of floating statoblasts and colonies; 2, the incompleteness of measurements for the various *Plumatella* species described in literature; 3, the considerable variation of both floating and sessile statoblasts of the various fresh-water Bryozoa; and 4, the confused synonymy of the *Plumatella* group. Reference to the measurements given by different authors for the several species and varieties of *Plumatella* did not solve the problem since none of the average measurements agreed completely with those of the Woods Hole *Plumatella* sp. statoblasts. The latter are larger than those of *P. repens typica* or *emarginata* of Study IX, pp. 200, 202, and are smaller than those from the *P. fungosa* var. *coralloides* of Harmer (1913, pp. 451–452). Because of this difficulty of identification it was deemed advisable to picture the statoblasts in Fig. 1 and to give their measurements in Table I.

In conclusion, one might say that there was some change in the fauna of this pond from last year to this. The Bryozoa, in which the writer is especially interested, seem to be in a period of transition. The fresh-water members had been killed off as a result of the accompanying effects of the hurricane late in 1938, the marine or brackish water forms thrived during the summer of 1939 and neither was alive in the summer of 1940. Collections in future years in the same locality should prove interesting.

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PROTOZOAN PARASITES OF THE ORTHOPTERA, WITH SPECIAL REFERENCE TO THOSE OF OHIO

III.[1] Protozoan Parasites in Relation to the Host and to Host Ecology

FRANK MERRICK SEMANS
The Ohio State University
and
Youngstown College

From July, 1932, to October, 1933, a total of 1287 orthopteran individuals were examined, representing 6 families and 99 species. Of these, 34 species and 244 individuals were found to be infected with protozoan parasites, and 33 species and 192 individuals with gregarines. Of 706 males, 131 or 19% were infected with protozoan parasites, and 96, or 14% with gregarines. Of these males, 116 were in nymphal stages and showed 26% infection with protozoan parasites and 8% infection with gregarines. The 590 adult males showed 17% infection with protozoan parasites, 15% with gregarines. Of 581 females, 113 or 19% were infected with protozoan parasites and 96, or 17% with gregarines. Of these females, 123 were nymphs, with 11% infection with protozoan parasites and 11% with gregarines. The 458 adult females showed 22% infection with protozoan parasites and 18% with gregarines.

All nymphs examined (239) showed 18% infection with protozoan parasites, 9% with gregarines. Total adults examined (1048) showed 19% infection with protozoan parasites, 16% with gregarines.

The discrepancies between the numbers of nymph and adult Orthoptera examined were considerable; however, the percentages of gregarine infection indicate that the adults were infected almost twice as often as nymphs. This does not apply to flagellate infection, where the infection of nymphs was close to that of adults.

Female Orthoptera presented a 3% higher degree of gregarine infection than the male. This is not a significant difference, the percentages of infection by all protozoan parasites being

[1]Part I: Ohio Journal of Science, November, 1936. Part II: Ohio Journal of Science, May, 1939.

practically the same in the two sexes. In a study of the parasites of *Blatta orientalis* Linnaeus, R. Kudo (1926) found a far greater infection by *Lophomonas blattarum* Stein and *L. striata* Bütschli in females than in males. In this study, conversely, the flagellate infection of male Blattidae ran considerably higher than that of females.

The Orthoptera examined are given by family and subfamily. They are classified according to Thomas (1933). References: Mead, 1904; Kirby, 1904, 1906, 1910; Kostir, 1914; Blatchley, 1920.

Blattidae

Five species of Blattidae were examined. *Ischnoptera deropeltiformis* (Brunner) was without parasites; *Parcoblatta virginica* (Brunner), a new host, harbored *Leptomonas* sp. and *Gregarina ohioensis* n. sp. in large numbers; *P. uhleriana* (Saussure), also a new host, harbored *G. parcoblattae* n. sp.; *P. lata* (Brunner), new host, harbored *Leptomonas* sp.; *P. pensylvanica* (DeGeer) harbored *Leptomonas* sp., *Gregarina thomasi* n. sp., *G. parcoblattae* n. sp., and *Nyctotherus ovalis* Leidy, variety.

Of 70 specimens of Blattidae examined, 60, or 86%, were infected with *Leptomonas* sp. in contrast to 15 individuals, or 21%, infected with gregarines. Thirty-eight out of 39 males (97%) were parasitized—all of the 21 nymphs, and 17 of the 18 (94%) adults. Of 31 females, 22 (71%) were infected, all of which were adults. Total nymph infection was 21 out of 23 examined (91%); total adult infection, 39 out of 47 examined (83%).

The flagellate infection of the Blattidae considerably exceeded the gregarine, which is conceivably the result of a difference in the concentration of digestive enzymes in the respective seats of infection, namely, the hind-intestine and the mid-intestine. H. S. Swingle (1925) shows that enzymes are not secreted by the hind-intestine of *Blatta orientalis* Linnaeus but may be found in that section of the alimentary canal near the mid-intestine, having been secreted in the latter. The gregarines are limited to the mid-intestine in their early development, inasmuch as that section of the alimentary canal is the only one where they have access to the epithelial layer, that of the other sections being protected by a chitinous layer; and the adult gregarines tend to remain in the mid-intestine.

Nyctotherus ovalis Leidy, variety ?, was taken from only one specimen (*Parcoblatta pensylvanica* (DeGeer), male nymph), which was surprising, considering the comparatively large number of Blattidae examined. However, this is the only case in which a ciliate has been reported for identified Blattidae other than the domestic cockroaches.

Phasmidae

Only one species of Phasmidae was examined—25 specimens of *Diapheromera femorata* (Say), and none of these had protozoan parasites.

This is the only orthopteran family for which no parasites have been reported and for which none were observed in this study.

Acrididae

Of the Acrididae, 39 species, representing four subfamilies, were examined. Those of the subfamily Acrydiinae are as follows: *Nemotettix cristatus compressus* Morse, unparasitized; *Acrydium ornatum* (Say), unparasitized; *A. arenosum angustum* (Hancock), a new host, harboring *Gregarina acrydiinarum* n. sp.; *Paratettix cucullatus cucullatus* (Burmeister), a new host, harboring *G. acrydiinarum* n. sp.; and *Tettigidea lateralis* (Say), unparasitized.

The species of the subfamily Acridinae are as follows: *Syrbula admirabilis* (Uhler), unparasitized; *Orphulella speciosa* (Scudder), unparasitized; *Dichromorpha viridis* (Scudder), a new host, harboring *Actinocephalus elongatus* n. sp.; *Chloealtis conspersa* Harris, unparasitized; *Chorthippus curtipennis curtipennis* (Harris), a new host, harboring *Gregarina rigida rigida* (Hall), and *G. indianensis* n. sp.

Species of the subfamily Oedipodinae examined are as follows: *Arphia sulphurea* (Fabricius), a new host, harboring *Gregarina rigida columna* n. subsp., *G. r. rigida* (Hall), and *Actinocephalus elongatus* n. sp.; *A. xanthoptera*, unparasitized; *Chortophaga viridifasciata* (DeGeer), a new host, harboring *Gregarina rigida columna* n. subsp. and *Actinocephalus elongatus* n. sp.; *Encoptolophus sordidus* (Burmeister), harboring a new parasite, *Gregarina rigida columna* n. subsp.; *Hippiscus rugosus* (Scudder), unparasitized; *Pardalophora apiculata* (Harris), a new host, harboring *G. rigida columna* n. subsp. and *Actinocephalus* sp.; *P. phoenicoptera* (Burmeister), unparasitized; *Dissosteira carolina* (Linnaeus), harboring a new parasite, *Gregarina rigida columna* n. subsp., in addition to *G. r. rigida* (Hall) and *G. locustae* Lankester; *Spharagemon bolli* Scudder, a new host, harboring *G. rigida columna* n. subsp. and *G. r. rigida* (Hall); *S. planum* Morse, unparasitized; *S. collare collare* (Scudder), a new host, harboring *G. rigida columna* n. subsp.; and *Trachyrachis kiowa thomasi* (Caudell), unparasitized.

Species of the subfamily Cyrtacanthacrinae examined are as follows: *Schistocerca americana americana* (Drury), harboring a new parasite, *Actinocephalus elongatus* n. sp. (?); *S. alutacea* (Harris), unparasitized; *Melanoplus gracilis* (Brunner), unparasitized; *M. facetus* Hubbell, unparasitized; *M. hinei* (Thomas), unparasitized; *M. obovatipennis* (Blatchley), a new host, harboring *Gregarina rigida columna* n. subsp. and *G. r. rigida* (Hall); *M. scudderi scudderi* (Uhler), a new host, harboring *G. rigida columna* n. subsp.; *M. walshii* Scudder, unparasitized; *M. differentialis* (Thomas), harboring *G. rigida columna* n. subsp., *G. r. rigida* (Hall), and *G. indianensis* n. sp.; *M. bivittatus* (Say), harboring *G. rigida columna* n. subsp., *G. r. rigida* (Hall), and *G. indianensis* n. sp.; *M. confusus* Scudder, unparasitized; *M. femur-rubrum femur-rubrum* (DeGeer), harboring *G. r. rigida* (Hall), *G. nigra* Watson, and *G. locustae* Lankester; *M. fasciatus* (F. Walker), unparasitized; *M. mexicanus mexicanus* (Saussure), harboring *G. rigida columna* n. subsp., *G. r. rigida* (Hall), *G. indianensis* n. sp., and *Actinocephalus elongatus* n. sp. (?); *M. keeleri luridus* (Dodge), harboring *Gregarina rigida columna* n. subsp.

and *G. r. rigida* (Hall); *Paroxya hooseri* Blatchley, unparasitized; and *P. atlantica atlantica* Scudder, unparasitized.

A total of 499 specimens of Acrididae were examined, and 87 of these (17%) were infected, the infected specimens representing 19 of the 39 species.

Tettigoniidae

In this study, no protozoan parasites were taken from the Tettigoniidae, although 285 specimens, representing 29 species, were examined. Only one protozoan parasite has been reported from the Tettigoniidae, namely, *Gregarina chagasi* Pinto (from *Neoconocephalus fratellus* (Griffini)). An adequate description of this gregarine is not available, and there is no illustration of it, hence its relation to the other gregarines cannot be determined.

The Tettigoniidae examined were as follows: *Scudderia curvicauda curvicauda* (DeGeer); *S. texensis* (Saussure and Pictet); *S. furcata furcata* Brunner; *Amblycorypha oblongifolia* (DeGeer); *A. uhleri* Stal; *A. rotundifolia rotundifolia* (Scudder); *Microcentrum rhombifolium* (Saussure); *M. retinerve* (Burmeister); *Pterophylla camellifolia* (Fabricius); *Neoconocephalus exiliscanorus* (Davis); *N. nebrascensis* (Bruner); *N. lyristes* (Rehn and Hebard); *N. robustus crepitans* (Scudder); *N. ensiger* (Harris); *N. palustris* (Blatchley); *N. retusus* (Scudder); *Orchelimum vulgare* Harris; *O. sylvaticum* McNeill; *O. nigripes* Scudder; *O. concinnum* Scudder; *O. campestre* Blatchley; *Conocephalus fasciatus fasciatus* (DeGeer); *C. brevipennis* (Scudder); *C. nemoralis* (Scudder); *C. strictus* (Scudder); *C. nigropleurum* (Bruner); *Atlanticus testaceus* (Scudder); *A. davisi* (Rehn and Hebard); and *A. americanus* (Saussure).

Gryllacridae

Eleven species of Gryllacridae were examined. These were as follows: *Tachycines asinamorus* (Adelung), a new host, harboring *Pileocephalus tachycines* n. sp.; *Hadenoecus puteanus* Scudder, a new host, harboring *Gregarina hadenoeci* n. sp.; *Ceuthophilus pallidipes* E. M. Walker, unparasitized; *C. latens* Scudder, unparasitized; *C. gracilipes* (Haldeman), a new host, harboring *G. proteocephala* n. sp. and *G. ceuthophili* n. sp.; *C. meridionalis* Scudder, unparasitized; *C. brevipes* Scudder, harboring a new parasite, *G. ceuthophili* n. sp.; *C. divergens* Scudder, a new host, harboring *G.* sp. and *G. ceuthophili* n. sp.; *C. uhleri* Scudder, a new host, harboring *G. prima* n. sp.; *C. nigricans nigricans* Scudder, unparasitized; and *C. thomasi* Hubbell, unparasitized.

Of a total of 145 specimens of Gryllacridae, 38, or 26%, of the individuals, and 6 of the 11 species, were infected.

Gryllidae

Of the Gryllidae, 14 species, representing four subfamilies were examined. Seven species of Gryllinae were as follows: *Gryllus assimilis* Fabricius, for which new parasites were named, harboring *Leidyana gryllorum* (Cuenot), *L. erratica* (Crawley), *Gregarina kingi* Crawley, *G. galliveri* Watson, and *G. oviceps* Diesing; *Gryllus domesticus* Linnaeus,

unparasitized; *Miogryllus verticalis* (Serville), unparasitized; *Nemobius fasciatus fasciatus* (DeGeer), a new host, harboring *Leidyana gryllorum* (Cuenot) and *L. erratica* (Crawley); *N. fasciatus tinnulus* Fulton, unparasitized; *N. fasciatus socius* Scudder, a new host, harboring *L. erratica* (Crawley); *N. maculatus* Blatchley, unparasitized.

Three species of the subfamily Oecanthinae were as follows: *Oecanthus nigricornus quadripunctatus* Beutenmüller, unparasitized; *O. nigricornus nigricornus* F. Walker, unparasitized; and *O. latipennis* Riley, unparasitized. It is interesting to note that no protozoan parasites have been reported from the Oecanthinae, although some of the same species of gregarines have been taken from subfamilies of the Gryllidae which are placed taxonomically on either side of the Oecanthinae by the orthopterists. This suggests, perhaps, a closer relationship between such isolated groups than has heretofore been suspected. The granular contents of the oecanthin gut are totally unlike the gut contents of the other Gryllidae examined by the author—a factor which may be correlated with the absence of parasites.

Two species of Trigonidiinae examined were *Anaxipha exigua* (Say), a new host, harboring *Leidyana erratica* (Crawley); and *Phyllopalpus pulchellus* Uhler, unparasitized.

Two species of Eneopterinae examined were *Hapithus agitator agitator* Uhler, a new host, harboring *Leidyana erratica* (Crawley), and *Gregarina galliveri* Watson; and *Orocharis saltator* Uhler, unparasitized.

Of a total of 263 specimens of Gryllidae examined, 52, or 20%, of the individuals, and 5 of the 14 species were infected.

The Orthoptera examined harbored protozoan parasites from three classes of Protozoa, namely, the Mastigophora (*Leptomonas* sp. in the Blattidae), the Sporozoa (many Gregarinida, in four families of Orthoptera), and the Infusoria (*Nyctotherus ovalis* Leidy, variety ? in one species of Blattidae).

SEAT OF PROTOZOAN PARASITE INFECTION

The predominating seat of gregarine infection is the extreme anterior end of the mid-intestine at the base of the enteric ceca. The infected region is often in a disintegrated condition—a dark, sticky mass—and for this reason it is often difficult if not impossible to determine to what extent the enteric ceca and the anterior end of the mid-intestine are involved. Occasionally only one or two ceca are infected; and sometimes, on the other hand, nearly the entire mid-intestine, or isolated spots towards the middle or posterior end are infected. It is doubtful that the anterior end is more susceptible to infection than any other part, but the sporozoites are probably liberated in that region by the action of enzymes on the spores and immediately penetrate the host tissue.

When the gregarine infection becomes well advanced, the sticky mass supplants the normal host tissue, and the gregarines appear on the celomic side, always adhering to the mass.

Gregarine cysts are found throughout the entire length of the mid- and hind-intestines. They are usually in masses along with sporonts and associations in the mid-intestine; in the hind-intestine they may

be found isolated among particles of debris in the gut contents. The largest number of cysts was found in some hosts which had been dead for about twelve hours, and it is likely that the uncontrolled action of the digestive enzymes after the death of the host is responsible for the encystation.

HOST ECOLOGY

Ecological factors were recorded for each of the localities in which Orthoptera were collected, and some suggestive correlations were noted.

In general, where the vegetation was abundant, the insect gut was distended and more likely to be parasitized. The greatest degree of parasitism was that of the acridid grasshoppers taken in the fairly abundant vegetation of the pockets of the arrested Indiana sand dunes, about a mile from the Lake Michigan shore. These acridids were almost 100% parasitized and their alimentary canals were expanded from feeding. Nowhere else were those particular species of Orthoptera found in such large numbers, and since they are scavengers and often cannibalistic, their prevalence was an additional factor contributing to the presence of many parasites. On the other hand, the acridids of the extremely arid prairie of the Kettle Hills (Fairfield County, Ohio) showed very little parasitism and were small gutted.

It is of interest to note that only those Orthoptera which live in burrows and cracks, or under logs and stones, and are carniverous, are especially parasitized. (There is a possibility of a light factor as well as the scavenger habits of the host influencing the prevalence of parasites.) Seasonal duration of the subdivisions of the Orthoptera might be considered a factor also, but the duration of the Acrididae, which are parasitized, is not essentially different from that of the Tettigoniidae, which are not parasitized.

In an attempt to correlate the pH of the anterior end of the orthopteran mid-intestine with protozoan prevalence and soil pH, 37 specimens of 4 families were studied. These were: 12 specimens of Acrididae with intestinal pH averaging 6.0; 4 specimens of Gryllacridae with intestinal pH averaging 5.9; 18 specimens of Tettigoniidae with intestinal pH averaging 5.6; 3 specimens of Gryllidae (*Oecanthus* spp.) with intestinal pH averaging 5.6. The degree of anterior mid-intestine acidity may be a factor in excluding parasites from the Tettigoniidae and certain Gryllidae (*Oecanthus* spp.), as the average pH of these groups was somewhat lower than that of the others examined.

Relating intestinal pH to the soil pH of the localities in which the insects were collected, it was found that 7 specimens were from localities with soil pH of 7.0, and their intestinal pH ranged from 5.9 to 6.6, averaging 6.3. The other 30 specimens came from localities where the soil pH was from 4.8 to 6.4, and their intestinal pH ranged from 5.6 to 5.9, averaging 5.7. Hence, intestinal acidity may possibly be correlated with that of the soil.

Each of the ecological factors constitutes a problem in itself, and many further possibilities for research are indicated.

SUMMARY

Ninety-nine species of Orthoptera were examined, with 34% infection; 1287 individual specimens, with 19% infection.

It is indicated that the protozoan parasites of the Orthoptera are host-specific for families and, to some extent, for subfamilies.

Protozoan parasites were taken from species of all of the major subdivisions of the Orthoptera studied, except the Phasmidae, Tettigoniidae, and Oecanthinae (subfamily of Gryllidae). The distinctive appearance of the gut contents and the gut pH of the latter two were correlated with the absence of parasites in these groups. The number of Phasmidae was too small to justify making a statement concerning the absence of parasites.

Twenty-two (or 24?) new hosts were recognized, and 12 (or 10?) hosts already studied were assigned new parasites. (The exact number is doubtful because of a few inaccurate host determinations made in the past.)

The infection by cephaline Gregarinida of nymph Orthoptera was approximately one-half as frequent as that of adults, but the degree of infection by flagellates (one species) was about the same in nymphs and adults. Female insects were infected by gregarines slightly more often than males; not nearly so often by flagellates. Ciliates (one species) were taken from one host only. No amoebae were observed.

The predominating seat of gregarine infection was the extreme anterior end of the mid-intestine at the base of the enteric ceca. However, other parts of the mid-intestine, including the enteric ceca were sometimes infected. Flagellates and ciliates were taken from the hind-intestine, particularly the colic region.

The average pH of the anterior end of the mid-intestine of Tettigoniidae and *Oecanthus* spp. of the Gryllidae (where there is probably no parasitism) was lower than that of specimens of two other orthopteran subdivisions which are known to be freely parasitized. There was a tendency for the gut pH to correlate with that of the soil of the locality in which the insect lived.

In general, the greatest degree of parasitism was in well-fed Orthoptera which were terrestrial, scavengers, and cannibalistic.

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Two New Bird Books

The aim of the publishers of these books has been to produce a pair of inexpensive books containing a colored picture and a brief description of the more common birds of eastern United States. Some 215 species are illustrated in the two volumes and for each of these (and about a dozen others) there is a brief description of 2–4 lines, followed by a paragraph or two about the bird. The text is simple, clear, and generally accurate.

The colored plates, 30 in each book, are those of Louis Agassiz Fuertes, borrowed from the New York State Museum. These plates are apparently becoming worn, as the reproduction in these books of a few of them is none too good. The order of the plates and species discussions follows that in "The Birds of New York," hence it does not conform entirely with the order in the latest (1931) A. O. U. Check List.

In the volume on songbirds there is a brief introduction on "Some Hints for Bird Study," which is well written and contains some good suggestions for the beginner. This is followed by the accounts of the species illustrated. In the first (songbird) volume the only references to plates are in the index; in the second the references to illustrations are in each description. No scientific names are mentioned anywhere in either book. The second book shows certain improvements over the first, particularly in the brief discussions of the more important bird groups; only a few groups are so treated in the songbird volume. At the end of each book is an index to the species treated, and a list of other books useful to the bird student.

In selecting species for treatment the author has selected 60 of the 106 Fuertes plates, and has discussed each species on these plates. The result is that a few unusual species (e. g., European goldfinch, evening grosbeak, purple sandpiper, and others) are included, while some fairly common species (e. g., the grebes, rails, some of the shore birds, the goatsuckers, waxwings, shrikes, and others) are omitted.

These books are handsomely gotten up and are printed on a good grade of heavy glazed paper. They are well bound and should stand considerable use. The particular volume on songbirds which this reviewer received lacked pp. 61–68, and had pp. 37–44 repeated in their place; it is a bit annoying to encounter this sort of thing in any book.

The general attractiveness of these books, and their low price, should insure their wide use. They are most siutable for juvenile readers and beginners in bird study; as reference books on birds they are of value largely because of the plates they contain, and in this respect they are incomplete.—*D. J. Borror.*

American Songbirds, by Maitland A. Edey. 72 pp. New York, Random House. 1940. $1.00.

American Water Birds, also Hawks, Owls, and Game Birds, by Maitland A. Edey. 72 pp. New York, Random House. 1941. $1.00.

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